Getting Started with Your VXIcpu-030® and the NI-VXI™ Software for the VxWorks Operating System

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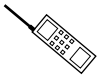

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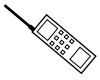

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About This Manual

This manual contains instructions for installing and configuring the National Instruments VXIcpu-030 embedded computer and the optional software development media.

How to Use This Documentation Set

Use this manual as a guide to installing and configuring the VXIcpu-030. Chapter 3, *NI-VXI Software Installation and Configuration*, is relevant only if you ordered the NI-VXI software. Refer to the *ESP-488 Software Reference Manual for the VXIcpu-030* for information about the ESP-488 software for the VxWorks operating system. Then use the *NI-VXI Text Utilities Reference Manual* and the *NI-VXI Software Reference Manual for C* to get a feel for the interactive utilities for the NI-VXI software and to develop your applications.

Organization of This Manual

This manual is organized as follows:

- Chapter 1, *Introduction*, describes the VXIcpu-030 kit and lists optional equipment you can order from National Instruments.
- Chapter 2, *VXIcpu-030 Configuration and Installation*, describes how to configure and install the VXIcpu-030.
- Chapter 3, *NI-VXI Software Installation and Configuration*, contains the instructions for installing and configuring the NI-VXI software for the VXIcpu-030 for the VxWorks operating system.
- Appendix A, *Specifications*, lists various module specifications such as physical dimensions and power requirements.
- Appendix B, *Front Panel Indicators*, describes the function of the seven LEDs on the front panel of the VXIcpu-030.
- Appendix C, *Connectors*, describes the VXIcpu-030 front panel and VXIbus connector pinouts.
- Appendix D, *Software Overview*, describes the programs and files that come with the NI-VXI software for the VXIcpu-030 for the VxWorks operating system.
- Appendix E, *Software Driver Installation for the Optional SCSI Internal Hard Disk*, describes the procedures for installing the software driver for the optional SCSI internal hard disk.

- Appendix F, *Enabling Virtual Memory for the VXIcpu-030 and VxWorks*, describes how to enable virtual memory for use with the VXIcpu-030 and the VxWorks operating system.
- Appendix G, *Common Questions*, addresses common questions you may have when configuring the VXIcpu-030 and the NI-VXI software for VxWorks.
- Appendix H, *Troubleshooting*, addresses certain problems that can occur after you have configured your VXIcpu-030 computer.
- Appendix I, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products and manuals.
- The *Glossary* contains an alphabetical list and description of terms used in this manual, including abbreviations, acronyms, metric prefixes, and mnemonics.
- The *Index* contains an alphabetical list of key terms and topics in this manual, including the page where you can find each one.

Conventions Used in This Manual

The following conventions are used in this manual:

bold	Bold text denotes a menu item, parameter, or a light-emitting diode (LED).
bold italic	Bold italic text denotes a note or warning.
italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
`monospace`	Text in monospace font denotes text or characters that are to be literally input from the keyboard, and for the proper names of programs, subprograms, filenames, and extensions.
IEEE 488 and IEEE 488.2	IEEE 488 and IEEE 488.2 are used throughout this manual to refer to the ANSI/IEEE Standard 488.1-1987 and the ANSI/IEEE Standard 488.2-1987, respectively, which define the GPIB.

Abbreviations, acronyms, metric prefixes, mnemonics, symbols, and terms are listed in the *Glossary*.

Related Documentation

The following documents contain information that you may find helpful as you read this manual:

- *IEEE Standard for a Versatile Backplane Bus: VMEbus*, ANSI/IEEE Standard 1014-1987
- *VxWorks Programmer's Guide*, Wind River Systems, Inc.
- VXI-1, *VXIbus System Specification*, Rev. 1.4, VXIbus Consortium
- VXI-6, *VXIbus Mainframe Extender Specification*, Rev. 1.0, VXIbus Consortium

Customer Communication

National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop using our products, and we want to help if you have problems with them. To make it easy for you to contact us, this manual contains comment and configuration forms for you to complete. These forms are located in Appendix I, *Customer Communication*, at the end of this manual.

Chapter 1
Introduction

This chapter describes the VXIcpu-030 kit and lists optional equipment you can order from National Instruments.

VXIcpu-030 Overview

The VXIcpu-030 embedded VXIbus computer is a high-performance, real-time platform for VXIbus systems. It is based on the 68030 microprocessor and has a hardware architecture similar to that of the popular Motorola MVME147S VMEbus processor board. The VXIcpu-030 features complete VXI functionality through interactive utilities and C function calls. It is a versatile centerpiece for many applications and includes the following standard interfaces:

- Intelligent Ethernet interface
- SCSI interface supported by onboard DMA
- High-performance IEEE 488/IEEE 488.2 interface
- Two RS-232 ports
- Internal hard disk drive (optional)
- Eight additional configurable RS-232/RS-422 ports (optional)
- Centronics-compatible printer interface (optional)

The full part number of the VXIcpu-030 is determined by configuration options corresponding to the extension -ABC in the part number. The A, B, and C variables are defined below.

A Hard Drive option
- 0 Without hard drive
- 3 With 514 MB hard drive

B Additional Serial/Parallel Port options
- 0 None
- 1 Serial (eight RS-232)
- 2 Serial (six RS-232; two RS-422)
- 3 Serial (four RS-232; four RS-422)
- 4 Serial (two RS-232; six RS-422)
- 5 Serial (eight RS-422)
- 6 Parallel (Centronics)

C Current Hardware Revision
- 0 Standard National Instruments version

Note: ***For information on configuring the serial port options, refer to the description of the optional RS232/RS422 connector in Appendix C,*** *Connectors.*

Optional Equipment

You can contact National Instruments to order any of the following items:

- NI-VXI Software for VXIcpu-030 for VxWorks

  The software kit includes National Instruments documentation for GPIB and VXI software.

- Type S5 DTE 9-pin to DCE 25-pin Console Cable—2 m
- Type S6 DTE 9-pin to DTE 9-pin Console Cable—2 m
- Type SCSI-B 25-pin D-Sub to 50-pin SCSI-2—2 m
- Type SCSI-G 50-pin SCSI-1 to 50-pin SCSI-2—2 m
- Type XI single-shielded GPIB cables—1 m, 2 m, 4 m, or 8 m*
- Type X2 double-shielded GPIB cables—1 m, 2 m, 4 m, or 8 m*

  * To meet FCC emission limits for a Class A device, you must use a double-shielded (Type X2) GPIB cable. Operating this equipment with a single-shielded (Type X1) GPIB cable may cause interference to radio and television reception in commercial areas.

Chapter 2
VXIcpu-030 Configuration and Installation

This chapter describes how to configure and install the VXIcpu-030. Read this chapter and install the VXIcpu-030 before installing the NI-VXI software as described in Chapter 3, *NI-VXI Software Installation and Configuration.*

Factory Configuration

The VXIcpu-030 is factory-configured to function as a VXIbus Slot 0 System Controller. This is the most commonly used configuration. The VXIcpu-030 is configured by switches and jumpers. Table 2-1 shows the details of the factory settings.

Table 2-1. VXIcpu-030 Factory Settings

Configuration	Factory Setting
Slot 0:	
System Controller	Enabled (bus arbiter and bus timer soft-configured)
VXIbus CLK10	Onboard source drives backplane only
MODID Terminator	16.9 kΩ pull-up
Front Panel CLK I/O	
Direction	Input (but not routed to backplane)
Termination	Not terminated
Front Panel Trigger Input	Not terminated
Front Panel Trigger Out	Disabled (soft-configured)
Installed System RAM	Per customer order
68882 Coprocessor	Per customer order

The System Controller functions include the System Clock (SYSCLK) driver, System Reset (SYSRESET) driver, daisy-chain drivers for BG and IACK, Bus Arbiter and Bus Timer. The Bus Arbiter mode and Bus Timer timeout durations are soft-configured, but are enabled or disabled by the Slot 0 System Controller configuration.

You can change the VXIcpu-030 configuration to match your system configuration requirements by changing the jumper and switch settings as described in this chapter, and by running the

`vxitedit` application as described in Chapter 3. The configurable features not listed in Table 2-1 are soft-configured by `vxitedit`.

VXIcpu-030 Configuration

The factory default settings of the jumpers and switch settings are suitable for most systems. Unless you need to alter the settings shown in Table 2-1, skip to the *Installing and Starting Up the VXIcpu-030* section, later in this chapter.

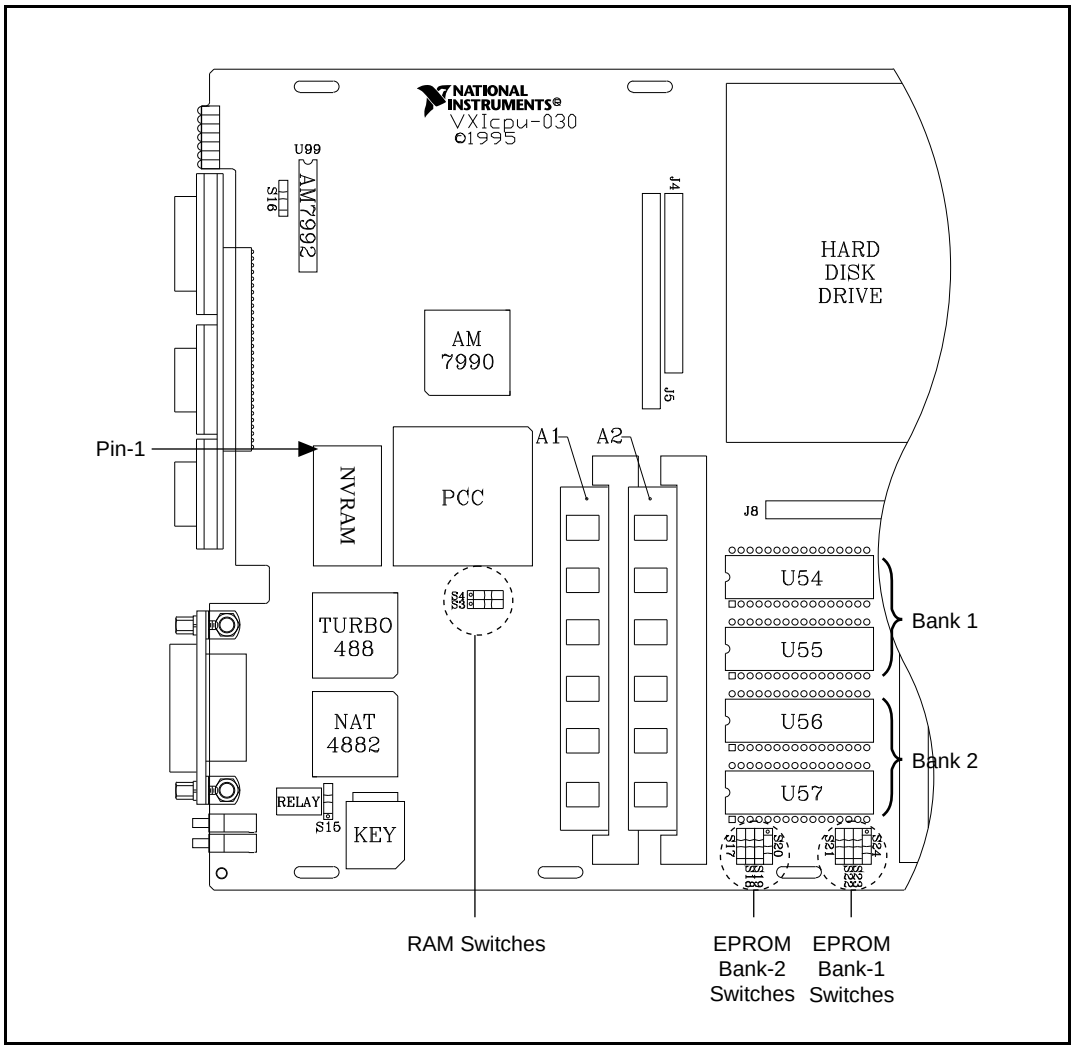


Figure 2-1. VXIcpu-030 Parts Locator Diagram (continues)

Figures 2-1 and Figure 2-3 show the location of the VXIcpu-030 configuration jumpers and switches, and their physical location relative to some of the major electrical components. The jumpers and switches are shown in their factory configuration settings. The configurable options are described in the following pages.

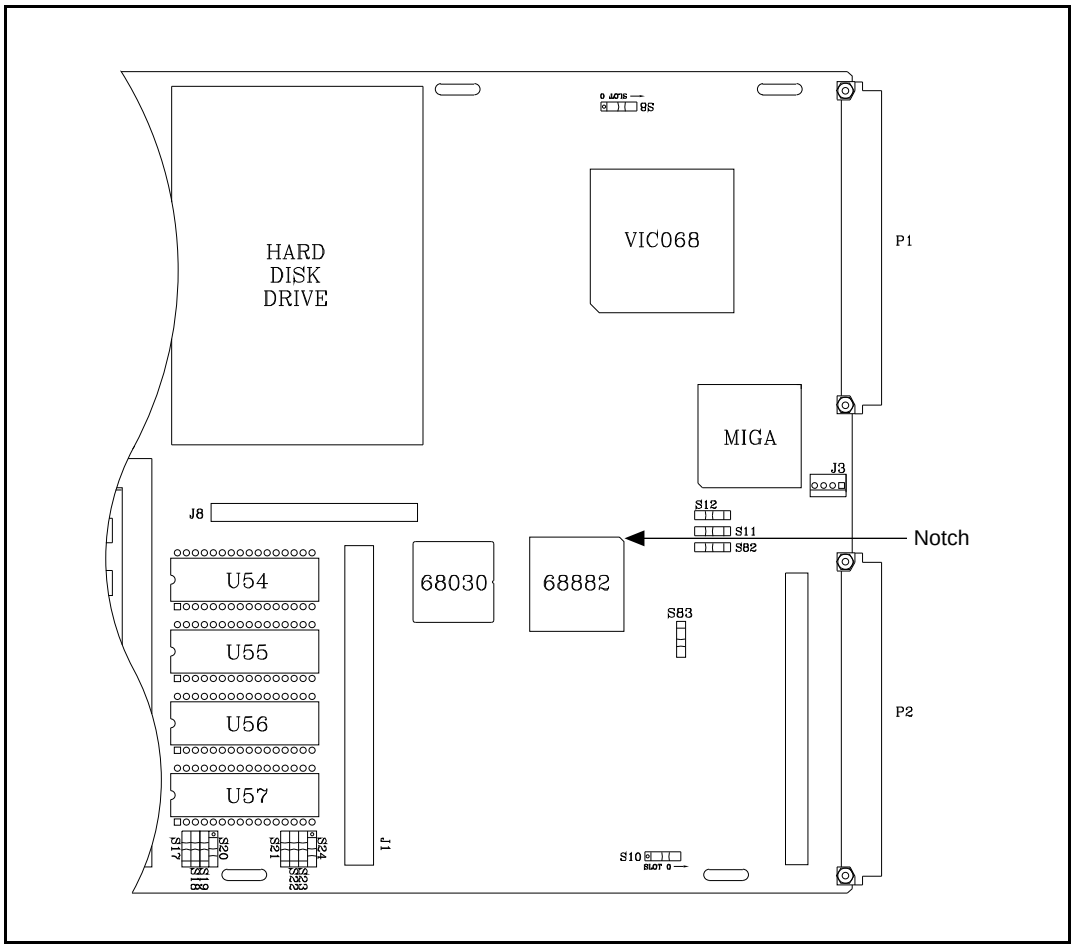


Figure 2-1. VXIcpu-030 Parts Locator Diagram (Continued)

Caution: ***Do not change the position of switches S15 or S16 unless directed by National Instruments. These switches should match the settings shown in Figure 2-2.***

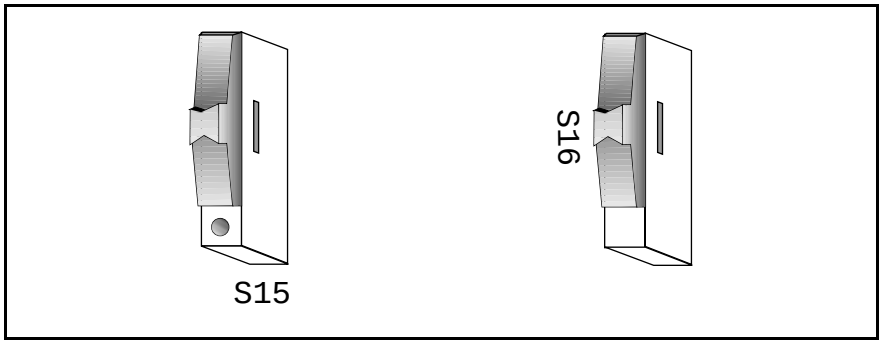


Figure 2-2. Proper Settings for S15 and S16

One jumper is located on the reverse side of the VXIcpu-030 module. As shown in Figure 2-3, the W1 jumper is accessible through an opening in the module. Refer to the *Slot Configuration* section later in this chapter for more information on the W1 jumper.

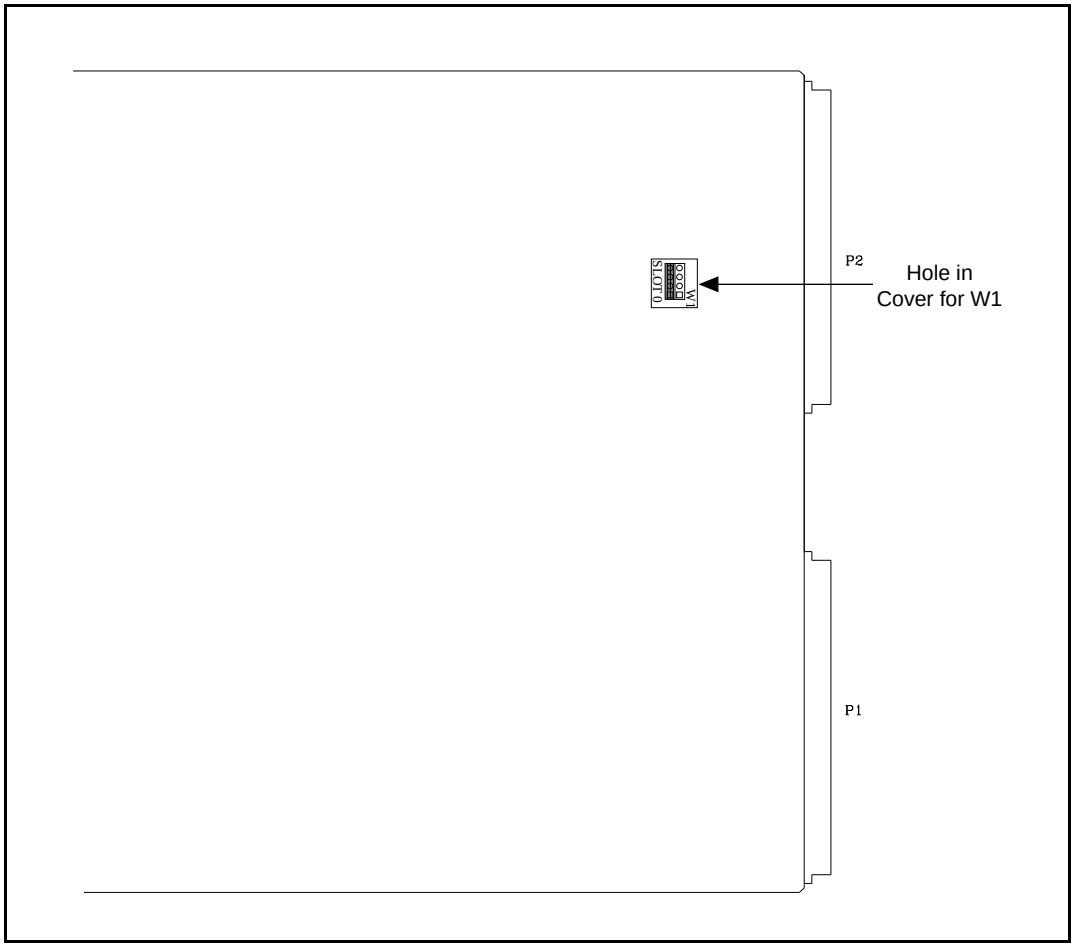


Figure 2-3. VXIcpu-030 Module–Left Side Cover

Configuration Procedure

Follow these steps to modify the factory settings:

1. Ground yourself and the VXIcpu-030. The VXIcpu-030 can be damaged by static discharge. You are less likely to damage the VXIcpu-030 if you place it on a properly grounded anti-static mat and use a grounded wriststrap.

2. Remove the screws that secure the right side cover. Remove the cover to expose the circuit card.

Note: ***If you wish to configure the VXIcpu-030 for non-Slot 0 operation and your system does not require the use of CLK I/O or the two trigger SMB connectors, you do not need to remove the cover. (Refer to the*** *Slot Configuration* ***section later in this chapter.)***

3. Alter the configuration as required, as described in the following section.

4. Replace the cover and the screws.

VXIbus Slot, CLK10, and External CLK I/O Configuration Options

Because the VXIbus slot, CLK10, and external (front panel) CLK I/O configuration options are interdependent, they are described together in this section.

The external clock interface is the SMB connector labeled *CLK I/O* on the VXIcpu-030 front panel. As an output, the CLK I/O is a TTL-level signal from a 50 Ω driver on the VXIcpu-030. As an input, it expects to be driven by a 10 MHz TTL signal. When configured as an input, the CLK I/O can be terminated with 50 Ω to ground, or left unterminated.

The slot position and front panel CLK I/O configuration options are shown in Table 2-2.

Table 2-2. VXIbus Slot Position and CLK I/O Configuration Options Summary

Configuration	VXIbus Slot	Front Panel CLK I/O	Applicable Configuration Figures S10	S8	W1	S11	S82	S83
A*	Slot 0	Not Used	2-4a	2-5a	2-6a	2-7a	2-8a	2-9a
B	Slot 0	Output (driven)	2-4a	2-5a	2-6a	2-7b	2-8a	2-9a
C	Slot 0	Input, unterminated	2-4a	2-5a	2-6a	2-7a	2-8a	2-9b
D	Slot 0	Input, 50 Ω terminated	2-4a	2-5a	2-6a	2-7a	2-8b	2-9b
E	Non-Slot 0	Not Used	2-4b	2-5b	2-6b	2-7a	2-8a	2-9b
F	Non-Slot 0	Output (driven)	2-4b	2-5b	2-6b	2-7b	2-8a	2-9b

* Factory configuration

Warning: ***Installing a VXIcpu-030 configured for Slot 0 operation into a slot other than Slot 0 can damage the VXIcpu-030, the backplane, and the Slot 0 device.***

In configuration A (see Table 2-1), an onboard source drives the differential ECL CLK10 backplane signals. Configuration B is similar to A, except that the VXIcpu-030 also drives the external CLK I/O connector with a 10 MHz TTL signal derived from backplane CLK10.

In configuration C, an external 10 MHz TTL reference source drives the backplane CLK10 signals, and the onboard source is disabled. Configuration D is similar to C, except that the external 10 MHz reference input is terminated with a 50 Ω resistor to ground.

In configuration E, the VXIcpu-030 accepts CLK10 from the backplane, terminating the differential ECL signals with 50 Ω resistors to -2 V. Configuration F is similar to E, except that the VXIcpu-030 also drives the external CLK I/O connector with a 10 MHz TTL signal derived from backplane CLK10.

Slot Configuration

You can configure the VXIcpu-030 to operate in Slot 0 or in Non-Slot 0 by correctly setting switches S8 and S10 and jumper W1. If your system does not require the use of the front panel CLK I/O or trigger SMB connectors, these are the only switches and jumper that you need to configure. Each of these three components is accessible through holes in the module, so you do not need to open the module if you want to modify only the slot configuration.

The S10 switch configures the MODID signal termination for Slot 0/Non-Slot 0 operation. When S10 is configured for Slot 0 operation (Figure 2-4a), the MODID signal is terminated with a 16.9 kΩ pull-up resistor. When S10 is configured for Non-Slot 0 operation (Figure 2-4b), the MODID signal is terminated with a 825 Ω pull-down resistor. The VXIcpu-030 is configured at the factory to be installed as a Slot 0 device.

You can set the S10 switch without opening the module, as it can be reached through an air vent along the side of the module. Refer to Figure 2-1 to determine the location of S10. You can access the S10 switch through the second air vent from the P2 connector. Figure 2-4 shows the possible settings for S10.

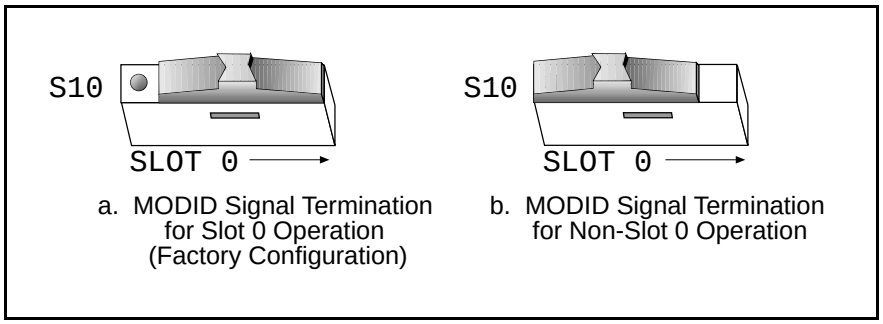

S10
SLOT 0
a. MODID Signal Termination for Slot 0 Operation (Factory Configuration)
S10
SLOT 0
b. MODID Signal Termination for Non-Slot 0 Operation

Figure 2-4. MODID Signal Termination Settings

The S8 switch configures the System Controller function for Slot 0/Non-Slot 0 operation. When S8 is configured for Slot 0 operation (Figure 2-5a), the VXIcpu-030 System Controller functions (SYSCLK and SYSRESET drivers, the Bus Arbiter and Bus Timer) are enabled. When S8 is configured for Non-Slot 0 operation (Figure 2-5b), the System Controller functions are disabled. The VXIcpu-030 is configured at the factory to be the VXIbus System Controller (Slot 0).

You can set the S8 switch without opening the module, as it can be reached through an air vent along the side of the module. Refer to Figure 2-1 to determine the location of S8. You can access the S8 switch through the third air vent from the P1 connector. Figure 2-5 shows the possible settings for S8.

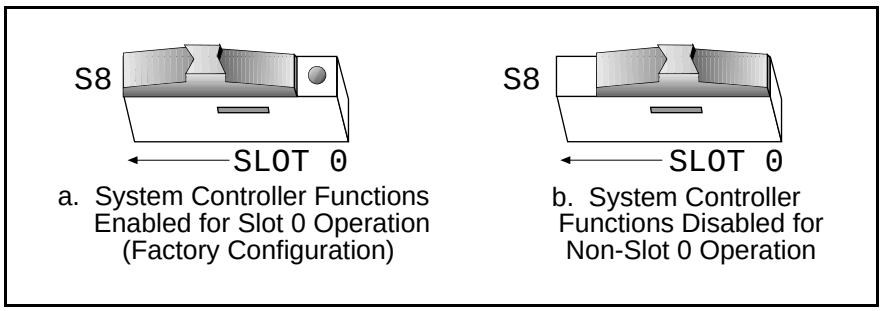

S8
SLOT 0
a. System Controller Functions Enabled for Slot 0 Operation (Factory Configuration)
S8
SLOT 0
b. System Controller Functions Disabled for Non-Slot 0 Operation

Figure 2-5. System Controller Settings

The W1 jumper configures the backplane CLK10 interface. You do not need to open the module to change this jumper setting. You can use a pair of small needle-nosed pliers to move the jumper setting. Figure 2-6 shows the possible settings for W1.

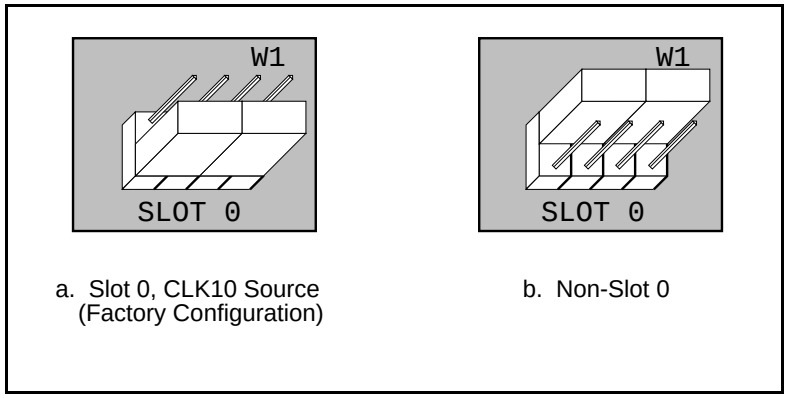


Figure 2-6. Backplane CLK10 Settings

Note: ***If you need to open the module for any reason, please follow the steps shown in the*** *Configuration Procedure* ***section, earlier in this chapter.***

Front Panel CLK I/O Interface

Switches S11, S82, and S83 configure the CLK I/O interface. Refer to Table 2-2 for valid combinations of these three switches.

Figure 2-7 shows the possible settings for S11.

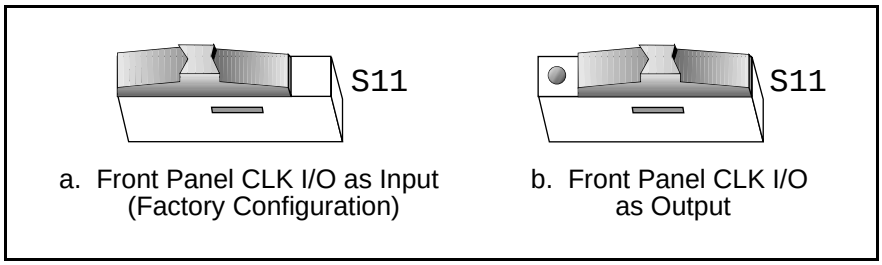


Figure 2-7. Front Panel CLK I/O Direction Settings

Figure 2-8 shows the possible settings for S82.

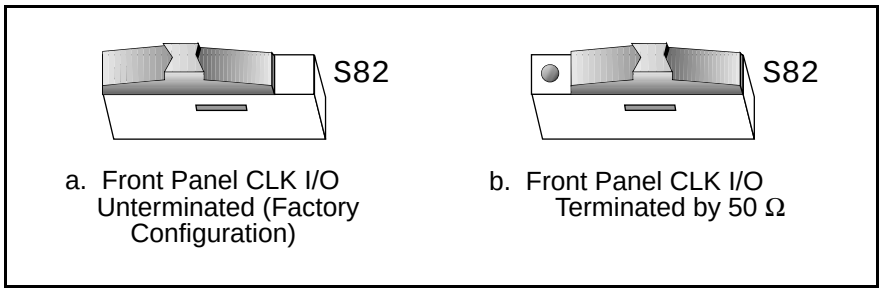


Figure 2-8. Front Panel CLK I/O Termination Settings

Figure 2-9 shows the possible settings for S83.

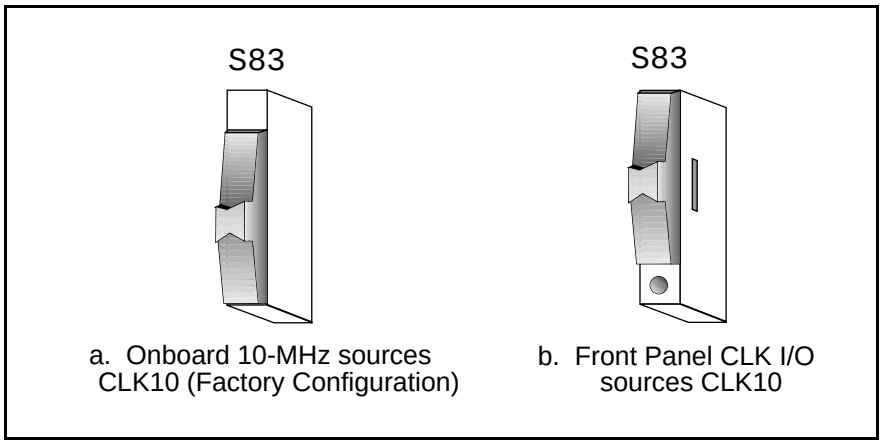


Figure 2-9. CLK10 Source Selection Settings

Figure 2-10 shows the factory configuration of the VXIcpu-030 CLK10 circuit.

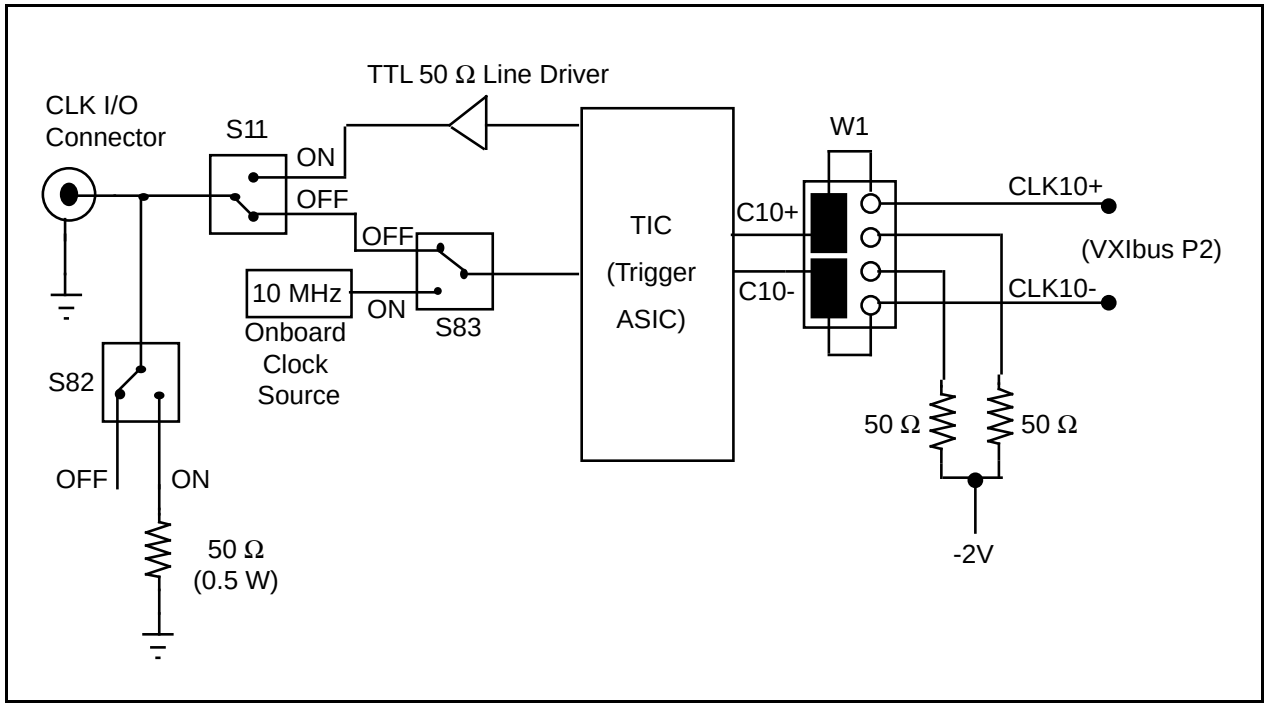


Figure 2-10. CLK10 Circuit Factory Configuration

External Trigger Input Configuration

The external TTL trigger input interface is the SMB connector labeled *TRG IN* on the VXIcpu-030 front panel. The external TTL trigger input can be terminated with a 50 Ω resistor to ground by changing the configuration of switch S12. Figure 2-11 shows the possible settings for S12.

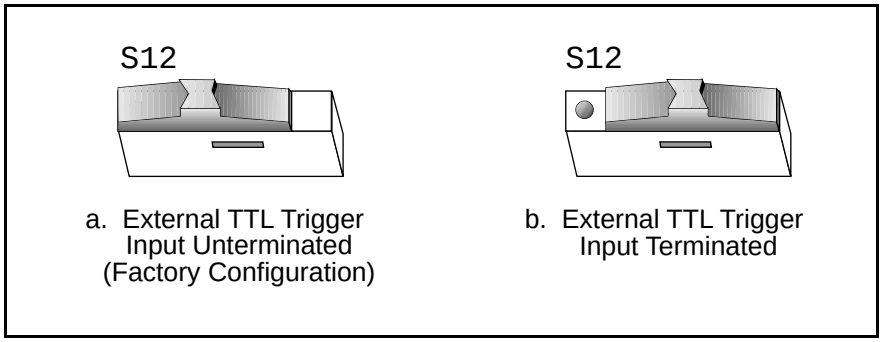


Figure 2-11. External Trigger Input Configuration Options

Figure 2-12 shows the external trigger input circuit.

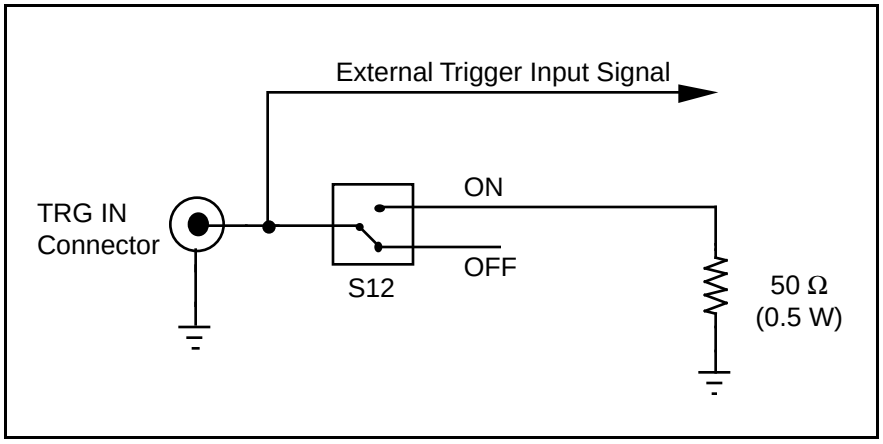


Figure 2-12. External Trigger Input Circuit

External Trigger Output Configuration

The external trigger output interface is the SMB connector labeled *TRG OUT* on the VXIcpu-030 front panel. Its configuration is done in software. Refer to Chapter 11, *VXI Trigger Functions*, of the *NI-VXI Software Reference Manual for C* for more information.

Installed System RAM Configuration

The amount of installed RAM is factory-configured per customer order. The options are 4, 8, 16, or 32 MB of installed DRAM. You can install a different amount of DRAM on the VXIcpu-030 by installing appropriate SIMMs A1 and A2 and changing the setting of switches S3 and S4.

The SIMMs should have the configuration shown in Table 2-3. The access time should be 70 ns or faster, and should support fast-page mode accesses. Use Toshiba THM36*xxxx*AS(G)-70 or equivalent.

Table 2-3. Additional RAM Configurations

Toshiba Part Number	SIMM Type A1	SIMM Type A2	Switch Settings S3	Switch Settings S4	Amount of RAM
THM361020AS(G)-70	1 M x 36	None	OFF	OFF	4 MB
THM361020AS(G)-70	1 M x 36	1 M x 36	OFF	ON	8 MB
THM364020S(G)-70	4 M x 36	None	ON	OFF	16 MB
THM364020S(G)-70	4 M x 36	4 M x 36	ON	ON	32 MB

Note: ***If you are installing 32 MB, please refer to*** *Step 1* ***in the*** *Installing the NI-VXI Software* ***section in Chapter 3,*** *NI-VXI Software Installation and Configuration****.***

You can install SIMMs by following these steps:

1. Place the SIMMs (in their shipping package) on the anti-static mat with the VXIcpu-030.

2. Remove the SIMMS from their anti-static packaging, and examine them for damage. Do not install damaged SIMMs onto the VXIcpu-030.

3. Locate the sockets (A1 and A2) on the VXIcpu-030 (See Figure 2-1).

Warning: ***Be sure to orient the SIMMs correctly before inserting them in the sockets. If you insert the SIMMs the wrong way, the SIMMs and the VXIcpu-030 will be damaged.***

4. Orient each SIMM so that the corner notch matches the position of the corner notch of the socket.

Warning: ***Avoid excessive pressure while inserting the SIMMs. Bending the circuit card could damage the VXIcpu-030.***

5. Insert each SIMM into its socket, pressing firmly and evenly to fully seat it.

Note: ***If for any reason you must return the VXIcpu-030 to National Instruments, be certain to insert the original RAM SIMMs that came with the board.***

68882 Floating Point Coprocessor Configuration

A 68882 floating-point coprocessor is installed at the factory, if ordered as an option.

You can install a 25 MHz Motorola 68882 floating-point coprocessor yourself by following these steps:

1. Place the 68882 (in its shipping package) on the anti-static mat with the VXIcpu-030.

2. Remove the 68882 from its anti-static packaging, and examine the connector pins on the underside. If any pins are bent, carefully straighten them with needle-nosed pliers.

3. Locate the 68882 socket on the VXIcpu-030 (See Figure 2-1).

Warning: ***Be sure to orient the 68882 correctly before inserting it in the socket. If you insert the chip the wrong way, the 68882 and the VXIcpu-030 will be damaged.***

4. Orient the 68882 so that the corner notch on the 68882 matches the position of the corner notch of the socket as shown in Figure 2-1.

Warning: ***Avoid excessive pressure while inserting the 68882. Bending the circuit card could damage the VXIcpu-030.***

5. Insert the 68882 into the socket, pressing firmly and evenly to fully seat the pins. The pins are barely visible when the chip is fully inserted into the socket.

Note: ***If for any reason you must return the VXIcpu-030 to National Instruments, be certain to remove the 68882 if you installed it yourself.***

NVRAM Configuration

A nonvolatile RAM chip (NVRAM) is installed at the factory. The NVRAM chip used is an MK48T02B-25 from SGS, or equivalent. The NVRAM is used to store nonvolatile configuration information for the VXIcpu-030, including the Ethernet address.

You can replace the NVRAM chip yourself by following these steps:

1. Locate the NVRAM chip on the VXIcpu-030 (See Figure 2-1).

2. Remove the NVRAM chip from its socket carefully.

3. Place the new NVRAM chip (in its shipping package) on the anti-static mat with the VXIcpu-030.

4. Remove the NVRAM chip from its anti-static packaging, and examine the pins. If any pins are bent, carefully straighten them with needle-nosed pliers.

Warning: ***Be sure to orient the NVRAM chip correctly before inserting it in the socket. If you insert the chip the wrong way, the NVRAM chip and the VXIcpu-030 will be damaged.***

5. Orient the NVRAM chip so that Pin-1 matches the position of Pin-1 as shown in Figure 2-1.

Warning: ***Avoid excessive pressure while inserting the NVRAM chip. Bending the circuit card could damage the VXIcpu-030.***

6. Insert the NVRAM chip into the socket, pressing firmly and evenly to fully seat the pins.

7. Restore the Ethernet address in the NVRAM as described below.

8. Restore the VXI Slave Timing Register in the NVRAM as described below.

9. If your VXIcpu-030 contains an internal hard disk, you need to restore the SCSI ID. Follow the instructions in Appendix E, *Software Driver Installation for the Optional SCSI Internal Hard Disk*. Pay particular attention to Step 4 in this appendix.

Restoring the Ethernet Address

The VXIcpu-030's Ethernet address is of the form 00802fxxxxxx. The *00802f* portion identifies the VXIcpu-030 as a product from National Instruments, and is hard-coded into the ROM. The *xxxxxx* portion of the Ethernet address is set at the factory to match the VXIcpu-030's serial number to ensure that the Ethernet address for each VXIcpu-030 is unique.

The *xxxxxx* portion is stored in the NVRAM on the VXIcpu-030 at address 0xfffe0778, and is a 24-bit number.

If for any reason you need to restore the Ethernet address in the NVRAM, perform the following steps:

1. Note the serial number of the VXIcpu-030 from the label on the module cover.

2. At the VxWorks command prompt, type in the following command sequence. For this example, the serial number is assumed to be 12345.

Note: ***This example uses the VxWorks*** `m` ***command at the VxWorks command prompt to modify/examine the serial number. Alternatively, you can create a function to write the three bytes starting at address 0xfffe0778.***

```
-> m 0xfffe0778
fffe0778:  0000-0123
fffe077a:  0000-4500
fffe077c:  0000-.
```

Restoring the VXI Slave Timing Register

The following addresses in the following locations in NVRAM contain hardware-specific values. Perform the following steps to restore the Slave Timing Register in the NVRAM:

1. Note the part number of the VXIcpu-030 from the label on the module cover.

2. Type in one of the following command sequences at the VxWorks command prompt.

   - If the part number is of the form 183513*x-xxx*, type in the following command sequence:

     ```
     -> m 0xfffe0400
     fffe0400:  0000-706d
     fffe0402:  0000-6861
     fffe0404:  0000-0000
     fffe0406:  0000-.
     ```

   - If the part number is of the form 182014*x-xxx*, type in the following command sequence:

     ```
     -> m 0xfffe0400
     fffe0400:  0000-706d
     fffe0402:  0000-6861
     fffe0404:  0000-5500
     fffe0406:  0000-.
     ```

EPROM Configuration

The EPROM on the VXIcpu-030 is divided into two banks. Your VXIcpu-030 was shipped from National Instruments with one EPROM bank (Bank-1) installed and two additional unoccupied sockets. These EPROM sockets are designed to accept many types of EPROM chips. When installing additional EPROMs in Bank-2 of your VXIcpu-030 board, refer to Table 2-4.

Note: ***Follow adequate anti-static procedures when installing EPROM chips on the VXIcpu-030.***

Table 2-4. Additional EPROM Configurations for Bank-2

Amount of Chip Type	Switch Settings for Bank-2				EPROM
	S17	S18	S19	S20	
27256	OFF	OFF	OFF	OFF	64 KB
27512 *	OFF	OFF	OFF	ON	128 KB
27010 *	OFF	OFF	OFF	ON	256 KB
27020	OFF	OFF	ON	ON	512 KB
27040	OFF	ON	ON	ON	1 MB
27080	ON	ON	ON	ON	2 MB

* Factory Setting

When you insert EPROMS into the board, orient them according to the silkscreen printed on the board as shown in Figure 2-1. The 27256 and 27512 EPROMs have fewer pins than the board locations. In this case, align the *bottom* pins of the EPROM with the *bottom* pins of the socket, leaving the top pins of the socket open, as illustrated in Figure 2-13. The access time of the EPROMs should be 200 ns or faster.

Warning: ***Improper EPROM installation can result in damage to the EPROM, the VXIcpu-030, or both.***

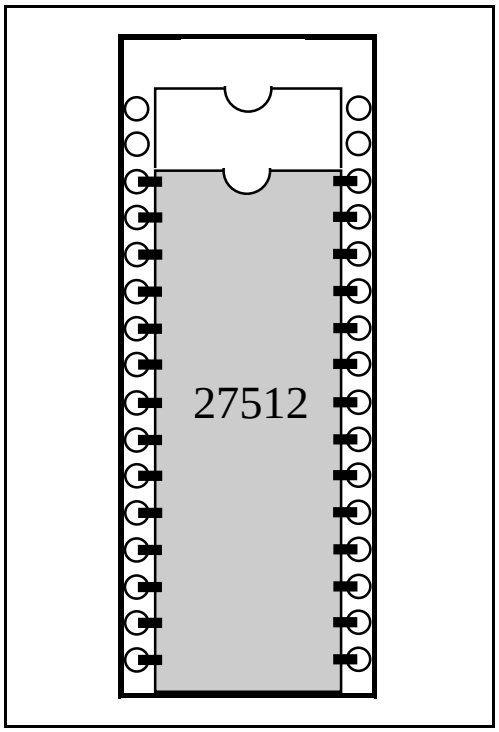


Figure 2-13. 28-pin EPROM Insertion Position

If you need to install different EPROMs in Bank-1, refer to Table 2-5.

Table 2-5. EPROM Configurations for Bank-1

Amount of Chip Type	Switch Settings for Bank-1				EPROM
	S21	S22	S23	S24	
27256	OFF	OFF	OFF	OFF	64 KB
27512 *	OFF	OFF	OFF	ON	128 KB
27010 *	OFF	OFF	OFF	ON	256 KB
27020	OFF	OFF	ON	ON	512 KB
27040	OFF	ON	ON	ON	1 MB
27080	ON	ON	ON	ON	2 MB

* Factory Setting

Note: ***If for any reason you must return the VXIcpu-030 to National Instruments, be certain to insert the original EPROMs that came with the board.***

Installing and Starting up the VXIcpu-030

If you have finished configuring the VXIcpu-030, you are now ready to install it in your mainframe. Use the following instructions to install the VXIcpu-030. Refer to your mainframe user manual for further instructions regarding mainframe configuration and module installation. Refer to Figure 2-14 to locate the VXIcpu-030 front panel connectors. The connectors are described in more detail in Appendix C, *Connectors*.

1. Turn off the mainframe power.

Warning: ***Installing a VXIcpu-030 configured for Slot 0 operation into a slot other than Slot 0 can result in damage to the VXIcpu-030, the backplane, and the Slot 0 device.***

2. If the VXIcpu-030 is configured for Slot 0 operation, install it in Slot 0. If the VXIcpu-030 is configured as a Non-Slot 0 device, install it in any slot other than Slot 0. Refer to your mainframe user manual for instructions regarding slot configuration.

3. Tighten the retaining screws at the top and bottom of the front panel.

4. Connect the Ethernet cable to the LAN connector, if required by your system. Use the appropriate adapter box (MAU).

5. Connect any supported SCSI device to the SCSI connector, if required by your system.

6. Connect serial devices to the CONSOLE and SERIAL B connectors, if required by your system. The CONSOLE port is the default serial port on the VXIcpu-030.

7. Connect a source or acceptor to the CLK I/O connector, if required by your system.

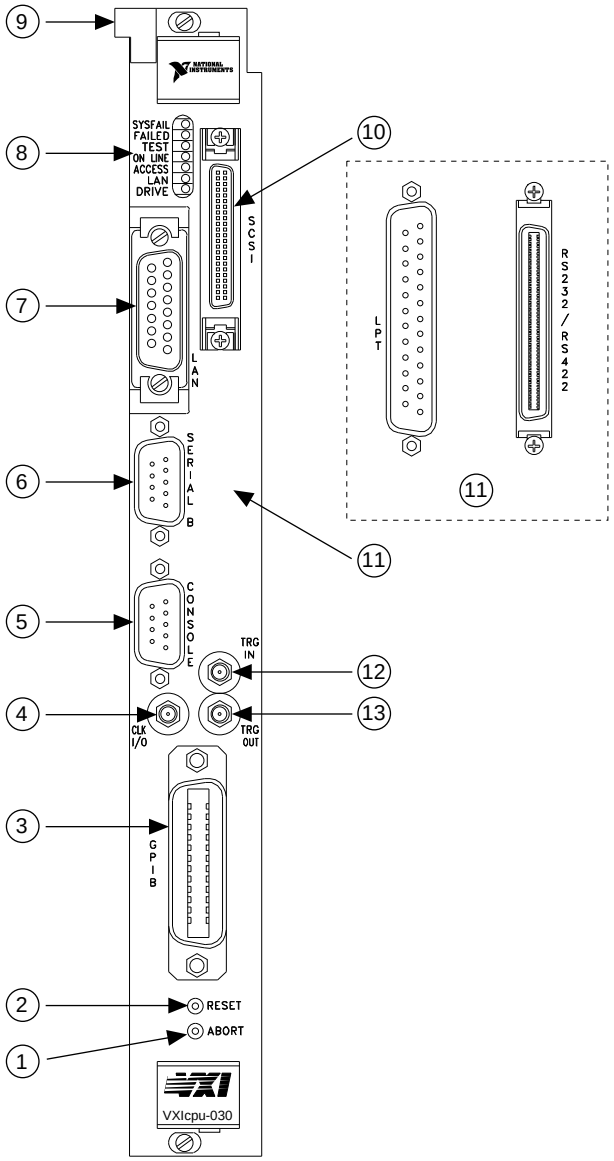
8. Connect the external trigger input signal source to the TRG IN connector, if required by your system.

9. Connect a trigger acceptor to the TRG OUT connector, if required by your system.

10. Connect GPIB devices to the GPIB connector, if required by your system.

11. To start up the VXIcpu-030, turn on the mainframe power. Power must also be applied to any peripherals used in your system configuration. After power is applied to the system, the normal boot sequence should begin.

The front panel LED indicators also provide information about the VXIcpu-030 and VXIbus system status. See Appendix B, *Front Panel Indicators*, for more information about the front panel indicators.



1	Abort Switch	5	Console	8	Status LEDs	11	Options (see inset)
2	Reset Switch	6	Serial B	9	Class 1 TTL Key	12	External Trigger Input
3	GPIB	7	Ethernet	10	SCSI	13	External Trigger Output
4	External 10-MHz Clock						

Figure 2-14. VXIcpu-030 Front Panel

Chapter 3
NI-VXI Software Installation and Configuration

This chapter contains the instructions for installing and configuring the NI-VXI software for the VXIcpu-030 for the VxWorks operating system. For a description of all the software components, refer to Appendix D, *Software Overview*. If you encounter problems using the NI-VXI software, consult Appendix G, *Common Questions*, and Appendix H, *Troubleshooting*.

Note: ***This chapter is relevant only if you ordered the NI-VXI software.***

Installing the NI-VXI Software

This section describes how to install the NI-VXI software on your VxWorks host development computer. Follow the procedures as explained in your *VxWorks Programmer's Guide* to install VxWorks onto your host computer, and then follow the procedures in this section to install the NI-VXI software.

Note: ***Step 1 deals with the amount of memory in your system. If you have less than 32 MB you can skip this step and start with Step 2.***

Step 1. Configure Your Memory

If you intend to use the 32 MB option, the VxWorks operating system must be configured as having 16 MB of RAM or less at startup. You must add the remaining RAM to the VxWorks memory pool after the VxWorks kernel is running.

This procedure is necessary to ensure that certain device drivers allocate their buffers in the lower 16 MB of RAM. These device drivers allocate memory only at system startup. Adding the other 16 MB of RAM after the kernel has booted prevents these drivers from allocating memory from the upper 16 MB.

Perform the following steps to configure VxWorks to use the 32 MB option. This example builds VxWorks with 4 MB at startup and the remaining 28 MB afterward.

1. Change the `LOCAL_MEM_SIZE` variable in the file `config.h` in the `config/niCpu030` directory to 0x00400000.

2. Rebuild the VxWorks kernel.

3. Invoke the following command either in your startup script or at the VxWorks shell to add the remaing 28 MB of memory.

   ```
   memAddToPool(0x00400000,0x01C00000)
   ```

The Board Support Package for the VXIcpu-030 exports a variable `sysMemSize`. You can query this variable to determine the amount of RAM installed in the VXIcpu-030. It will detect memory only up to 16 MB.

For more details about initializing the memory pool, refer to the *Configuration* chapter in your *VxWorks Programmer's Guide*.

Step 2. Set Up a Working Directory

1. Create a working directory (for example, `dist`) and change to that directory.

   ```
   mkdir dist
   cd dist
   ```

2. Copy the files from the NI-VXI software media to this directory using the `tar` command. For example, if you are using Solaris 1 on a Sun workstation, use the following command:

   ```
   tar -xvfZ /dev/rfd0c
   ```

   The files are transferred to the hard drive in the right directory structure.

Step 3. Install the Driver into the System

Run the VXI installation shell script `install` in your working directory by executing

`./install <`*`VxWorks root directory`*`>`

Make sure that you have access to this directory.

Loading the NI-VXI Software

This section describes the options for loading and linking the NI-VXI software for use with your application software.

One option is to load the NI-VXI software into the VxWorks operating system before your application requires it. Typically, the startup script performs the loading process.

A second option is to actually link the NI-VXI software into the VxWorks system image. Linking in this manner ensures that the necessary functions are available as soon as the operating system is booted.

The NI-VXI modules must be loaded in a specific order so that the VxWorks load time linker can locate all of the necessary symbols for each application. The `nivxi.o` module must be loaded first because the other NI-VXI utilities rely on symbols located in `nivxi.o`.

The following code is a typical startup script for loading the NI-VXI modules at boot time.

```
ld < /usr/vw/config/niCpu030/nivxi/nivxi.o
ld < /usr/vw/config/niCpu030/nivxi/resman.o
ld < /usr/vw/config/niCpu030/nivxi/vxitedit.o
ld < /usr/vw/config/niCpu030/nivxi/victext.o
vxiinit()
```

Configuring the NI-VXI Software

Run `vxiinit` to initialize and display the VXIcpu-030 configuration settings. The default configuration is Slot 0 System Controller, Resource Manager (Logical Address 0), message-based device. To change the current settings, or to view the configuration options, run the VXI resource editor program, `vxitedit`, and select the Configuration Editor from the main menu.

You can use `vxitedit` to edit the description of the VXIcpu-030 or any other device that is installed in the system. In this program, you can easily modify the configuration tables required for VXIbus and MXIbus operation. You can also use this program to configure interrupts, triggers, and the utility bus for single- or multiple-mainframe system configurations. For more details on how to use the `vxitedit` program, refer to the *NI-VXI Text Utilities Reference Manual.*

Running vxitedit

Use `vxitedit`, the text-based VXI resource editor program, to configure the system and to edit the manufacturer name and ID numbers, the model names of VXI and non-VXI devices in the system, and the system interrupt configuration information. This program also displays the system configuration information generated by the Resource Manager.

Type `vxitedit` to run the resource editor program. Select the **Configuration Editor** from the main menu. The first three configuration options are **Logical Address Configuration**, **Bus Configuration**, and **Device Configuration**. These options modify both nonvolatile memory and configuration files to store information about the configuration of your system. This information includes shared RAM size, VXI register contents, and VXIbus interface parameters. The fourth option, **Save Configuration**, commits your changes to the nonvolatile memory and configuration files.

Configuration files are accessed relative to the access path specified in the device configuration editor. The default destination directory pathname used by the program is `/usr/vw/config/niCpu030/nivxi/tbl` and `/usr/vw/config/niCpu030/nivxi/hlp`. The fifth option, **Restore Configuration**, lets you read the configuration files into the corresponding structures in nonvolatile memory.

Type `help` to obtain online assistance within any editor. This help includes determining which commands are applicable to the editor your are using. Type `save` to apply any changes you have made. Type `exit` to exit the editor. Type `abort` if you want to exit without saving your changes. When you return to the main menu, you can enter another editor by selecting the number for that editor.

For further instructions on the use of the `vxitedit` program, refer to the *NI-VXI Text Utilities Reference Manual*.

The following sections describe the various configuration options available under the Logical Address, Bus, and Device Configuration Editors.

Logical Address Configuration

Table 3-1 describes the options available under the Logical Address Configuration Editor.

Table 3-1. Logical Address Configuration Characteristics

Characteristic	Description	Default Value
Logical Address	An 8-bit number that uniquely identifies the VXIcpu-030. If it is set to 0, it is the VXIbus Resource Manager. Logical Addresses 0 through 254 specify a static device, while Logical Address 255 specifies a dynamic device. Range = 0 to 254	0
Device Type	Indicates the classification of the VXIbus device. Affects only the contents of the Device Class field in the Device Type register. The functionality of the other registers does not change. 1 = Extended 2 = Message-Based 3 = Register-Based	2
Address Space	Indicates the addressing mode(s) of the device's operational registers. 0 = A16/A24 1 = A16/A32 3 = A16 only	3

(continues)

Table 3-1. Logical Address Configuration Characteristics (Continued)

Characteristic	Description	Default Value
VXI Shared RAM	Indicates the size of VXI Shared RAM. The VXIcpu-030 local RAM can be slave-accessed in either A24 or A32 space in D08(EO), D16, and D32 data transfer modes. As an A16-only device, this field is disabled. You should set this field to match the amount of RAM installed on your VXIcpu-030.	None
Slave Block Transfer Mode	The VXIcpu-030 does not currently support block transfers in VXIbus slave mode. This field is statically configured to reflect this with a value of 0 and cannot be changed.	0
Slave Supervisory Access Only	Determines the type of accesses that the VXIcpu-030 acknowledges. 0 = The VXIcpu-030 acknowledges both supervisory and nonprivileged accesses. 1 = The VXIcpu-030 acknowledges only supervisory accesses. Nonprivileged accesses will result in a bus error. This is true for all A16, A24, and A32 slave accesses.	0
Resource Manager Delay	Time in seconds that the Resource Manager waits before accessing any other VXIbus device's A16 configuration registers. Range = 0 to 65535 s	5 s
Servant Area Size	Servant Area size supplied when the VXIcpu-030 receives the *Read Servant Area* command from the Resource Manager. The Servant Area size is an 8-bit value (0 through 255) that indicates the VXIcpu-030 Servant area. The Servant area begins at the logical address following the VXIcpu-030 logical address, and includes *N* contiguous logical addresses, where *N* is the value of the Servant Area size. This field is valid only when the VXIcpu-030 is configured as a message-based device. If the VXIcpu-030 *is* the Resource Manager, this setting is irrelevant. Range = 0 to 255	0

(continues)

Table 3-1. Logical Address Configuration Characteristics (Continued)

Characteristic	Description	Default Value
Protocol Register	Copy of the Protocol register, indicating which protocols the device supports. This field is valid only when the VXIcpu-030 is configured as a message-based device. (Refer to the *VXIbus System Specification.*)	0x0ff0
Response for *Read Protocol* Command	The response value to a *Read Protocol* command received by the VXIcpu-030 from the Resource Manager (if the VXIcpu-030 is *not* the Resource Manager in your system). This field is valid only when the VXIcpu-030 is configured as a message-based device. (Refer to the *VXIbus System Specification*.)	0x8448
Number of Handlers	The number of interrupt handlers that the VXIcpu-030 supports. Range = 0 to 7	1
Number of Interrupters	The number of interrupters that the VXIcpu-030 supports. Range = 0 to 7	0
WS Poll Value	The (scaled) number of iterations polling the Response register before yielding control in Word Serial operations. Range = 1 to 65535	100

Bus Configuration

Table 3-2 describes the options available under the Bus Configuration Editor.

Table 3-2. Bus Configuration Characteristics

Characteristic	Description	Default Value
Bus Request Level	Sets up the level at which the VXIcpu-030 requests bus mastership. Permitted Levels = 0 to 3	3
Fair Requester Timeout	Fair Requester Range = 2 to 28 µs (in increments of 2). A value of zero (0) implies that the fair requester is disabled.	0 (disabled)
Bus Release Mechanism	Sets up the VXI bus release mechanism. 0 = Release On Request 1 = Release When Done	0
Bus Arbitration	Sets the VXI bus arbitration mode. This field is relevant only when the VXIcpu-030 is a Slot 0 device. 0 = Priority 1 = Round Robin	0
Local Bus Timeout	Sets the timeout period for the VXIcpu-030 onboard local bus (not the VXI local bus). Range = 4 to 512 µs in powers of 2, or 0 (disabled)	32 µs
VXI Bus Timeout	Sets the timeout period for the VXIbus bus timeout (BTO) unit. The unit is disabled if the VXIcpu-030 is not the System Controller. Range = 4 to 512 µs in powers of 2, or 0 (disabled)	128 µs
VIC Port	Specifies the width of the VIC port. The 68030 onboard processor can be forced into dynamic bus sizing mode from one 32-bit transfer to two 16-bit transfers. Some devices can support only 16-bit (D16 VXI) transfers and require the software to break up 32-bit transfers in this manner. 0 = 16-bit port 1 = 32-bit port	1

Device Configuration

Table 3-3 describes the characteristics of the options available under the Device Configuration Editor.

Table 3-3. Device Configuration Characteristics

Characteristic	Description	Default Value
NI-VXI Path	Specifies the location of the NI-VXI `.cfg`, `.tbl`, and `.hlp` files.	`/usr/vw/config/niCpu030/nivxi`
Pushbutton Reset to SYSRESET Action	Determines how the VXIcpu-030 responds to a pushbutton reset. In any case the VXIcpu-030 is reset locally. 0 = Does not assert SYSRESET on the backplane. 1 = Does assert SYSRESET on the backplane.	1
SYSRESET Action	Determines how the VXIcpu-030 responds to a SYSRESET on the backplane. 0 = Does not reboot the VXIcpu-030. However, all the hardware registers on the VXIcpu-030 are reset, and the VXIcpu-030 asserts SYSFAIL on the backplane. In this situation, you must run `vxiinit` to reinitialize the hardware registers and to remove SYSFAIL. This field is statically configured to 0 and cannot be changed.	0
Pushbutton Reset to Local Reset Action	Determines how the VXIcpu-030 responds to a pushbutton local reset. 0 = Does not reset locally. 1 = Does reset locally.	1

Exiting vxitedit and Reinitializing the Hardware

Type `exit` from the main menu to quit the `vxitedit` program. If you changed any of the software configuration information, `vxitedit` prompts you to save your changes before exiting the configuration menu. Saving the configuration information updates the nonvolatile memory. Run `vxiinit` to reinitialize the hardware according to the new settings.

If you changed any of the software configuration settings from the default, record the new settings on the *VXIcpu-030 Hardware and Software Configuration Form* in Appendix I.

Developing Your VXI Application Program

The easiest way to learn how to communicate with your VXI instruments is by controlling them interactively. Use the VXI interactive control program (`victext`) to write to and read from your VXI instruments. `victext` displays the status of your VXI transactions and displays any errors that occur. Refer to the *NI-VXI Text Utilities Reference Manual* on how to use `victext` and to learn about its features.

Note: ***After installing the NI-VXI software, run*** `vxiinit` ***and then*** `resman`***.***

To cross-compile and link your application `appl.c` using the GNU toolkit supplied with VxWorks so that it can use the NI-VXI driver, you would include the `nivxi.h` header file in your program and enter the following command on the host computer:

```
cc68k -c appl.c -o appl.o
```

Then enter the following command on the VXIcpu-030:

```
ld < appl.o
```

The `example` subdirectory contains various example programs and a makefile that show how to use various functions in the NI-VXI software and how to develop application programs using these functions.

Appendix E contains information on installing the software driver for the optional SCSI internal hard disk. Appendix F describes how to enable virtual memory for use with the VXIcpu-030 and VxWorks.

For more information on the VxWorks development environment, refer to the *VxWorks Programmer's Guide*.

Appendix A
Specifications

This appendix lists various module specifications such as physical dimensions and power requirements.

Processing Unit

Microprocessor	25 MHz 68030
Numeric Coprocessor (optional)	25 MHz 68882

Memory and Storage

RAM	4, 8, 16, or 32 MB
NVRAM	2 KB
Hard Disk (optional)	514 MB

Physical Dimensions

C-size VXIbus Module

Slot Requirements	1 slot

Front Panel

Indicators

- **SYSFAIL** (red)
- **FAILED** (red)
- **ACCESS** (yellow)
- **TEST** (green)
- **ON LINE** (green)
- **LAN** (yellow)
- **DRIVE** (yellow)

Connectors

- LAN (Ethernet)
- SCSI
- CONSOLE serial port
- SERIAL B serial port
- CLK I/O connector (for 10 MHz TTL clock)
- TRG IN trigger input connector
- TRG OUT trigger output connector
- GPIB
- Optional LPT (printer) or eight RS-232/RS-422 ports

Pushbuttons

- Reset
- Abort

Power Requirements

Source	Direct Current (Max)	Dynamic Current (Max)
+5 VDC	6.0 A	Not Available
+12 VDC	500 mA	Not Available
-12 VDC	200 mA	Not Available
-5.2 VDC	100 mA	Not Available
-2 VDC	150 mA	Not Available

Cooling Requirements

Power Dissipation, max	40 W

Operating Environment

Temperature	0° to 55° C
Relative Humidity	0% to 95% noncondensing
Emissions	FCC Class A

Storage Environment

Temperature	-40° to 85° C
Relative Humidity	0% to 100% noncondensing

IEEE 488 Functionality

Capability Code	Description
SH1	Source Handshake
AH1	Acceptor Handshake
T5, TE5	Talker, Extended Talker
L3, LE3	Listener, Extended Listener
SR1	Service Request
PP1, PP2	Local/Remote Parallel Poll
C1, C2, C3, C4, C5	Controller
E1, E2	Tri-State Bus Drivers with Automatic Switch to Open Collector during Parallel Poll

VXIbus Functionality

- VXIbus System Specification Compatible
- Multimainframe Resource Manager (defeatable)
- Slot 0 Support (defeatable)
- Message-Based Commander and Servant
- Dynamically Configurable
- Programmable Interrupter (any combination of seven levels)
- Programmable Handler (any combination of seven levels)
- Trigger Source/Acceptor (SYNC, SEMI-SYNC, ASYNC, STST protocols)
- External Trigger I/O Support
- External CLK10 I/O Support
- A16/A24/A32 Addressing
- D08(EO)/D16/D32 Data Paths
- Read-Modify-Write Cycles
- Unaligned Transfers

Appendix B
Front Panel Indicators

This appendix describes the function of the seven LEDs on the front panel of the VXIcpu-030. The significance of each LED is determined by its color: red, green, or yellow. Red indicates a failure, while green indicates an active state, and yellow indicates that a board resource is being accessed.

The red **SYSFAIL** LED is lit whenever the VMEbus SYSFAIL* signal is asserted. This LED does not indicate which VXIbus module is asserting the signal.

The **FAILED**, **TEST**, and **ON LINE** LEDs are the VXIcpu-030 status indicators. Table B-1 describes the status sequence indicated by the condition of the status LEDs. The point of failure is indicated for states where the **FAILED** LED is lit for an extended period of time.

Table B-1. Status LED Indicators

Sequence	FAILED	TEST	ON LINE	State	Point of Failure
1	OFF	OFF	OFF	No Power	
2	ON	OFF	OFF	Power On, but failed	Failed before self-test/ self-initialization
3	ON	ON	OFF	In self-initialization	Failed self-test/self-initialization
4	OFF	ON	OFF	Self-initialization done	
5	OFF	ON	ON	Performing RM	
6	ON	ON	ON	Failed	Failed while in RM
7	OFF	OFF	ON	Online	
8	ON	OFF	ON	Failed	Failed while online

The yellow **ACCESS** LED is lit when the VXIcpu-030 MODID line is asserted or when the VXIbus registers or shared memory are accessed by another bus master.

The yellow **LAN** LED is lit when the Ethernet interface is accessing memory. Its intensity is a measure of the local bus bandwidth used by the Ethernet interface.

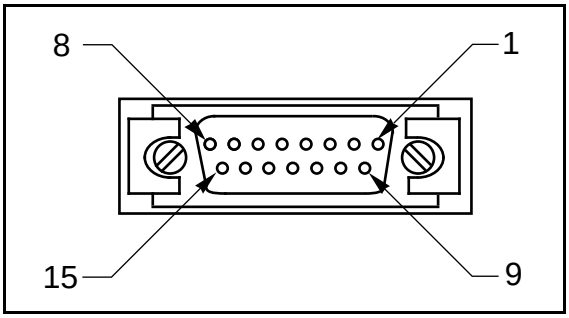
The yellow **DRIVE** LED is the hard disk drive access light. It is lit when the internal hard drive is in use.

Appendix C
Connectors

This appendix describes the VXIcpu-030 front panel and VXIbus connector pinouts.

Note: ***The illustrations in this appendix show the mating face of the connectors. An asterisk suffix (*) on a signal name indicates that the signal is active low.***

LAN



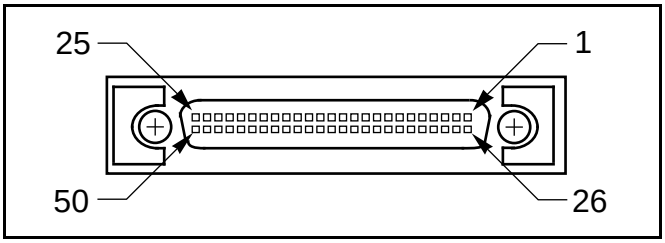
This is the IEEE 802.3 DTE standard connector.
Connector type: 15-pin D-Sub Receptacle (HD20)

Figure C-1. LAN Connector

Table C-1. LAN Connector Signals

Pin	Signal Name	Signal Description	802.3 Signal Name
1	GND	Ground	Control In circuit Shield
2	CD+	Collision Detect (+)	Control In circuit A
3	TX+	Transmit (+)	Data Out circuit A
4	GND	Ground	Data In circuit Shield
5	RX+	Receive (+)	Data In circuit A
6	GND	Ground	Voltage Common
7	n.c.	Not Connected	Control Out circuit A
8	GND	Ground	Control Out circuit Shield
9	CD-	Collision Detect (-)	Control In circuit B
10	TX-	Transmit (-)	Data Out circuit B
11	GND	Ground	Data Out circuit Shield
12	RX-	Receive (-)	Data In circuit B
13	+12VDC	Transceiver Power	Voltage Plus
14	GND	Ground	Voltage Shield
15	n.c.	Not Connected	Control Out circuit B

SCSI



Connector type: 50-pin High Density SCSI Device Connector

Figure C-2. SCSI Connector

Table C-2. SCSI Connector Signals

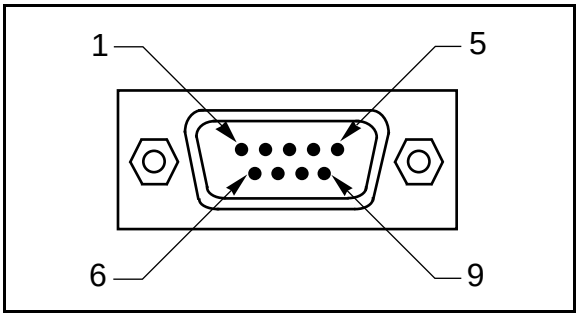
Pin	Signal Name	Signal Description
1	GND	Ground
2	GND	Ground
3	GND	Ground
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	GND	Ground
12	GND	Ground
13	n.c.	Not Connected
14	GND	Ground
15	GND	Ground
16	GND	Ground
17	GND	Ground
18	GND	Ground
19	GND	Ground
20	GND	Ground
21	GND	Ground
22	GND	Ground
23	GND	Ground
24	GND	Ground
25	GND	Ground
26	DB(0)*	Data Bus (0)
27	DB(1)*	Data Bus (1)
28	DB(2)*	Data Bus (2)
29	DB(3)*	Data Bus (3)
30	DB(4)*	Data Bus (4)
31	DB(5)*	Data Bus (5)

(continues)

Table C-2. SCSI Connector Signals (continued)

Pin	Signal Name	Signal Description
32	DB(6)*	Data Bus (6)
33	DB(7)*	Data Bus (7)
34	DBP*	Data Bus Parity
35	GND	Ground
36	GND	Ground
37	GND	Ground
38	TERMPWR	Terminator Power (+5 VDC)
39	GND	Ground
40	GND	Ground
41	ATN*	Attention
42	GND	Ground
43	BSY*	Busy
44	ACK*	Acknowledge
45	RST*	Reset
46	MSG*	Message
47	SEL*	Select
48	C*/D	Control/Data
49	REQ*	Request
50	I*/O	Input/Output

CONSOLE



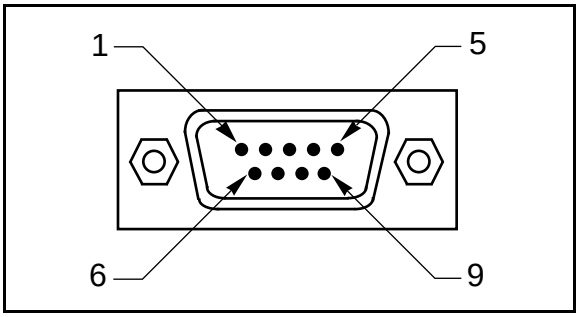
Connector type: 9-pin D-Sub Plug (HD-20)

Figure C-3. CONSOLE Connector

Table C-3. CONSOLE Connector Signals

Pin	Signal Name	Signal Description
1	DCD*	Data Carrier Detect
2	RXD*	Receive Data
3	TXD*	Transmit Data
4	DTR*	Data Terminal Ready
5	GND	Ground
6	DSR*	Data Set Ready
7	RTS*	Ready to Send
8	CTS*	Clear to Send
9	n.c.	Not Connected

SERIAL B



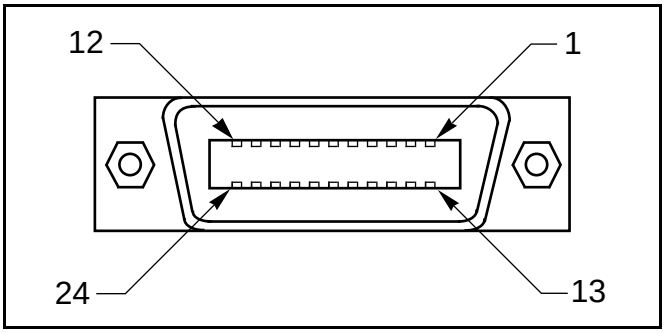
Connector type: 9-pin D-Sub Plug
(HD-20)

Figure C-4. SERIAL B Connector

Table C-4. SERIAL B Connector Signals

Pin	Signal Name	Signal Description
1	DCD*	Data Carrier Detect
2	RXD*	Receive Data
3	TXD*	Transmit Data
4	DTR*	Data Terminal Ready
5	GND	Ground
6	DSR*	Data Set Ready
7	RTS*	Ready to Send
8	CTS*	Clear to Send
9	GND	Ground

GPIB



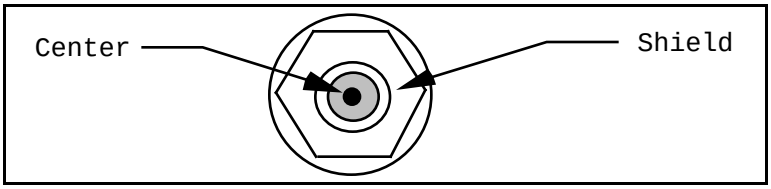
Connector Type: GPIB

Figure C-5. GPIB Connector

Table C-5. GPIB Connector Signals

Pin	Signal Name	Signal Description
1	DIO1*	Data Bit 1
2	DIO2*	Data Bit 2
3	DIO3*	Data Bit 3
4	DIO4*	Data Bit 4
5	EOI*	End or Identify
6	DAV*	Data Valid
7	NRFD*	Not Ready for Data
8	NDAC*	Not Data Accepted
9	IFC*	Interface Clear
10	SRQ*	Service Request
11	ATN*	Attention
12	SHIELD	Chassis ground
13	DIO5*	Data Bit 5
14	DIO6*	Data Bit 6
15	DIO7*	Data Bit 7
16	DIO8*	Data Bit 8
17	REN*	Remote Enable
18	GND	Logic Ground
19	GND	Logic Ground
20	GND	Logic Ground
21	GND	Logic Ground
22	GND	Logic Ground
23	GND	Logic Ground
24	GND	Logic Ground

CLK I/O



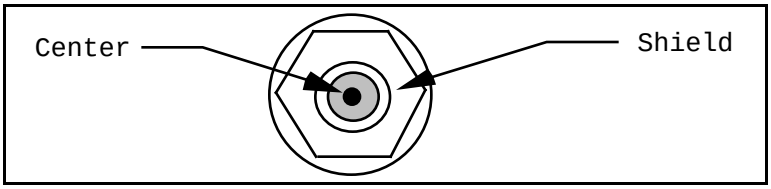
Connector Type: SMB

Figure C-6. CLK I/O Connector

Table C-6. CLK I/O Connector Signals

Pin	Signal Description
Center	CLK10 I/O Signal (10-MHz TTL)
Shield	Ground

TRG IN



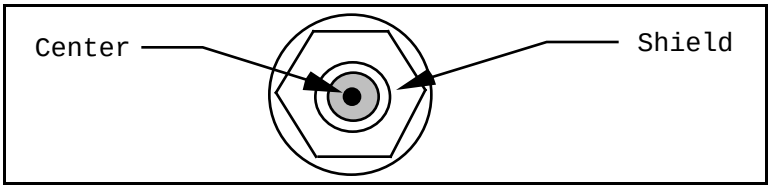
Connector Type: SMB

Figure C-7. TRG IN Connector

Table C-7. TRG IN Connector Signals

Pin	Signal Description
Center	Trigger Input Signal (TTL)
Shield	Ground

TRG OUT



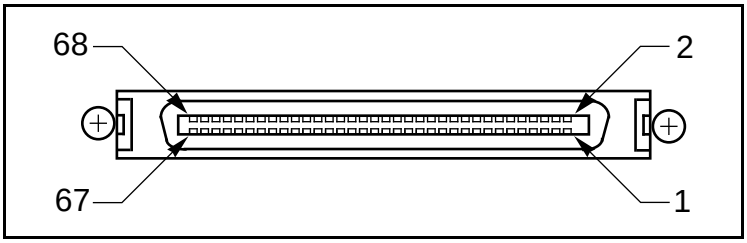
Connector Type: SMB

Figure C-8. TRG OUT Connector

Table C-8. TRG OUT Connector Signals

Pin	Signal Description
Center	Trigger Output Signal (TTL 50Ω driver)
Shield	Ground

RS232/RS422 (Option)



Connector type:
68-position 3M D-Ribbon,
3M part number 10268-5212VE

Figure C-9. RS232/RS422 Connector

Table C-9. RS232/RS422 Connector Signals

Pin	Signal Name	Signal Description (RS-232)	Signal Description (RS-422)
1	RXD7-	Receive Data 7	Receive Data 7 circuit B
2	CTS7-	Clear to Send 7	Clear To Send 7 circuit B
3	RXD7+	Not Used	Receive Data 7 circuit A
4	CTS7+	Not Used	Clear To Send 7 circuit A
5	TXD7-	Transmit Data 7	Transmit Data 7 circuit B
6	RTS7-	Request To Send 7	Request To Send 7 circuit B
7	TXD7+	Not Used	Transmit Data 7 circuit A
8	RTS7+	Not Used	Request To Send 7 circuit A
9	RXD6-	Receive Data 6	Receive Data 6 circuit B
10	CTS6-	Clear to Send 6	Clear To Send 6 circuit B
11	RXD6+	Not Used	Receive Data 6 circuit A
12	CTS6+	Not Used	Clear To Send 6 circuit A
13	TXD6-	Transmit Data 6	Transmit Data 6 circuit B
14	RTS6-	Request To Send 6	Request To Send 6 circuit B
15	TXD6+	Not Used	Transmit Data 6 circuit A
16	RTS6+	Not Used	Request To Send 6 circuit A
17	RXD5-	Receive Data 5	Receive Data 5 circuit B
18	CTS5-	Clear to Send 5	Clear To Send 5 circuit B
19	RXD5+	Not Used	Receive Data 5 circuit A
20	CTS5+	Not Used	Clear To Send 5 circuit A
21	TXD5-	Transmit Data 5	Transmit Data 5 circuit B
22	RTS5-	Request To Send 5	Request To Send 5 circuit B
23	TXD5+	Not Used	Transmit Data 5 circuit A
24	RTS5+	Not Used	Request To Send 5 circuit A
25	CTS4-	Clear to Send 4	Clear To Send 4 circuit B
26	GND	Ground	Ground
27	CTS4+	Not Used	Clear To Send 4 circuit A
28	GND	Ground	Ground

(continues)

Table C-9. RS232/RS422 Connector Signals (continued)

Pin	Signal Name	Signal Description (RS-232)	Signal Description (RS-422)
29	RTS4-	Request To Send 4	Request To Send 4 circuit B
30	RXD4-	Receive Data 4	Receive Data 4 circuit B
31	RTS4+	Not Used	Request to Send 4 circuit A
32	RXD4+	Not Used	Receive Data 4 circuit A
33	CTS3-	Clear To Send 3	Clear To Send 3 circuit B
34	TXD4-	Transmit Data 4	Transmit Data 4 circuit B
35	CTS3+	Not Used	Clear To Send 3 circuit A
36	TXD4+	Not Used	Transmit Data 4 circuit A
37	RTS3-	Request To Send 3	Request To Send 3 circuit B
38	RXD3-	Receive Data 3	Receive Data 3 circuit B
39	RTS3+	Not Used	Request To Send 3 circuit A
40	RXD3+	Not Used	Receive Data 3 circuit A
41	GND	Ground	Ground
42	TXD3-	Transmit Data 3	Transmit Data 3 circuit B
43	GND	Ground	Ground
44	TXD3+	Not Used	Transmit Data 3 circuit A
45	RXD2-	Receive Data 3	Receive Data 2 circuit B
46	CTS2-	Clear To Send 2	Clear To Send 2 circuit B
47	RXD2+	Not Used	Receive Data 2 circuit A
48	CTS2+	Not Used	Clear To Send 2 circuit A
49	TXD2-	Transmit Data 2	Transmit Data 2 circuit B
50	RTS2-	Request To Send 2	Request To Send 2 circuit B
51	TXD2+	Not Used	Transmit Data 2 circuit A
52	RTS2+	Not Used	Request To Send 2 circuit A
53	RXD1-	Receive Data 1	Receive Data 1 circuit B
54	CTS1-	Clear To Send 1	Clear To Send 1 circuit B
55	RXD1+	Not Used	Receive Data 1 circuit A
56	CTS1+	Not Used	Clear To Send 1 circuit A
57	TXD1-	Transmit Data 1	Transmit Data 1 circuit B
58	RTS1-	Request To Send 1	Request To Send 1 circuit B
59	TXD1+	Not Used	Transmit Data 1 circuit A
60	RTS1+	Not Used	Request To Send 1 circuit A
61	RXD0-	Receive Data 0	Receive Data 0 circuit B
62	CTS0-	Clear To Send 0	Clear To Send 0 circuit B
63	RXD0+	Not Used	Receive Data 0 circuit A
64	CTS0+	Not Used	Clear To Send 0 circuit A
65	TXD0-	Transmit Data 0	Transmit Data 0 circuit B
66	RTS0-	Request To Send 0	Request To Send circuit B
67	TXD0+	Not Used	Transmit Data 0 circuit A
68	RTS0+	Not Used	Request To Send 0 circuit A

Optional RS232 and RS422 Ports

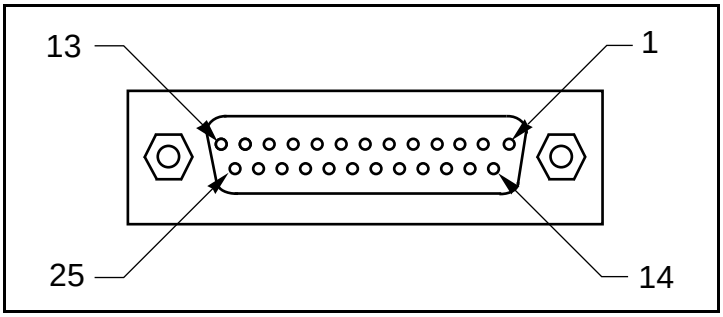
The part number printed on the label on the VXIcpu-030 module indicates the configuration of the RS232/RS422 option. There are eight serial ports in this option. The second digit in the module part number extension (that is, variable B in -ABC) indicates how these optional RS232/RS422 ports are configured—whether RS232 or RS422.

The following table shows the relationship between the part number on the module and the configuration of the eight ports. For information on the meaning of the A and C variables, refer to Chapter 1, *Introduction.*

Table C-10. Configuring the Optional RS232/RS422 Ports

Module Part Number Extension	**Port Configuration**	
	RS232 Port Numbers	**RS422 Port Numbers**
-A1C	Port-0 through Port-7	None
-A2C	Port-0 through Port-5	Port-6 through Port-7
-A3C	Port-0 through Port-3	Port-4 through Port-7
-A4C	Port-0 through Port-1	Port-2 through Port-7
-A5C	None	Port-0 through Port-7

LPT (Option)



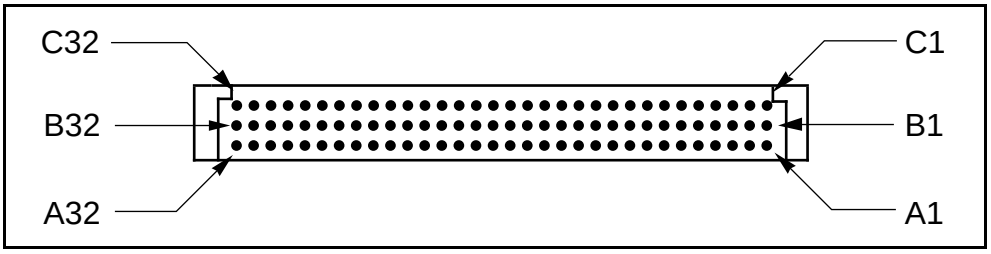
Connector type: 25-pin
D-Sub Receptacle
(HD-20)

Figure C-10. LPT Connector

Table C-11. LPT Connector Signals

Pin	Signal Name	Signal Description
1	STROBE*	Data Strobe
2	D0	Data Bit 0
3	D1	Data Bit 1
4	D2	Data Bit 2
5	D3	Data Bit 3
6	D4	Data Bit 4
7	D5	Data Bit 5
8	D6	Data Bit 6
9	D7	Data Bit 7
10	ACK*	Acknowledge
11	BUSY*	Device Busy
12	PE	Paper End
13	SLCT	Select
14	n.c.	Not Connected
15	ERROR*	Error
16	INIT*	Initialize Printer
17	n.c.	Not Connected
18	GND	Ground
19	GND	Ground
20	GND	Ground
21	GND	Ground
22	GND	Ground
23	GND	Ground
24	GND	Ground
25	GND	Ground

VXIbus P1 and P2



Connector Type:
96-pin DIN

Figure C-11. VXIbus Connector

Table C-12. VXIbus P1 Connector Signals

Pin	Row A Signals	Row B Signals	Row C Signals
1	D00	BBSY*	D08
2	D01	BCLR*	D09
3	D02	ACFAIL*	D10
4	D03	BG0IN*	D11
5	D04	BG0OUT*	D12
6	D05	BG1IN*	D13
7	D06	BG1OUT*	D14
8	D07	BG2IN*	D15
9	GND	BG2OUT*	GND
10	SYSCLK	BG3IN*	SYSFAIL*
11	GND	BG3OUT*	BERR*
12	DS1*	BR0*	SYSRESET*
13	DS0*	BR1*	LWORD*
14	WRITE*	BR2*	AM5
15	GND	BR3*	A23
16	DTACK*	AM0	A22
17	GND	AM1	A21
18	AS*	AM2	A20
19	GND	AM3	A19
20	IACK*	GND	A18
21	IACKIN*	n.c.	A17
22	IACKOUT*	n.c.	A16
23	AM4	GND	A15
24	A07	IRQ7*	A14
25	A06	IRQ6*	A13
26	A05	IRQ5*	A12
27	A04	IRQ4*	A11
28	A03	IRQ3*	A10
29	A02	IRQ2*	A09
30	A01	IRQ1*	A08
31	-12 V	n.c.	+12 V
32	+5 V	+5 V	+5 V

Table C-13. VXIbus P2 Connector Signals

Pin	Row A Signals	Row B Signals	Row C Signals
1	ECLTRG0	+5 V	CLK10+
2	-2 V	GND	CLK10-
3	ECLTRG1	n.c.	GND
4	GND	A24	-5.2 V
5	MODID12	A25	LBUSC (0)
6	MODID11	A26	LBUSC (1)
7	-5.2 V	A27	GND
8	MODID10	A28	LBUSC (2)
9	MODID09	A29	LBUSC (3)
10	GND	A30	GND
11	MODID08	A31	LBUSC (4)
12	MODID07	GND	LBUSC (5)
13	-5.2 V	+5 V	-2 V
14	MODID06	D16	LBUSC (6)
15	MODID05	D17	LBUSC (7)
16	GND	D18	GND
17	MODID04	D19	LBUSC (8)
18	MODID03	D20	LBUSC (9)
19	-5.2 V	D21	-5.2 V
20	MODID02	D22	LBUSC (10)
21	MODID01	D23	LBUSC (11)
22	GND	GND	GND
23	TTLTRG0*	D24	TTLTRG1*
24	TTLTRG2*	D25	TTLTRG3*
25	+5 V	D26	GND
26	TTLTRG4*	D27	TTLTRG5*
27	TTLTRG6*	D28	TTLTRG7*
28	GND	D29	GND
29	n.c.	D30	n.c.
30	MODID00	D31	GND
31	GND	GND	+24 V
32	SUMBUS	+5 V	-24 V

Appendix D
Software Overview

This appendix describes the programs and files that come with the NI-VXI software for the VXIcpu-030 for the VxWorks operating system.

Note: ***This chapter is relevant only if you ordered the NI-VXI software for the VXIcpu-030 and the VxWorks Operating System.***

The software components are as follows:

- VxWorks target software
- Serial Expansion Port software
- Parallel Port software
- ESP-488 GPIB software
- NI-VXI software

VxWorks Software Overview

The VxWorks Development System must be ordered separately from Wind River Systems, Inc. This manual assumes that you have installed the VxWorks Development System on your host computer and that you have configured the VXIcpu-030 according to the *VxWorks Programmer's Guide*. You will find any upgrades or changes to these files in the `config/niCpu030/niCpu030` directory on your distribution media.

Serial Port Software Overview

The serial port software is a set of routines to operate the eight optional RS-232/RS422 serial ports on the VXIcpu-030. This software is included on the software development distribution media for the VXIcpu-030 for the VxWorks operating system. A `README` file contains a description of the files that make up the serial port software. You will find the `README` file along with the serial port software in the `config/niCpu030/serial` directory.

Parallel Port Software Overview

The parallel port software is a set of routines to control the optional Centronics parallel port on the VXIcpu-030. This software is included in the software development distribution media for the VXIcpu-030 for the VxWorks operating system. A `README` file contains a description of the files that make up the parallel port software. You will find the `README` file along with the parallel port software in the `config/niCpu030/parallel` directory.

ESP-488 GPIB Software Overview

The ESP-488 software is a comprehensive set of routines to control GPIB devices. This software is included on the software development distribution media for the VXIcpu-030 for the VxWorks operating system in the `config/niCpu030/gpib` directory. Refer to the *ESP-488 Software Reference Manual for the VXIcpu-030* for information about using this software.

NI-VXI Software Overview

The following sections describe the files that make up the NI-VXI software for the VXIcpu-030 for the VxWorks operating system.

Main Programs and Files

The main programs and files of the NI-VXI software appear in the `/usr/niCpu030/nivxi` directory on the hard drive after you complete the installation of the NI-VXI software.

- `nivxi.o` is the NI-VXI interface library. In addition to the functions described in the *NI-VXI Software Reference Manual for C*, this loadable object contains the `vxiinit` function. (`VXIinit` is an alias of `vxiinit`.) This function initializes the board interrupts, shared RAM, VXI register configurations, and bus configurations. You must run this function at least once after restarting your machine to initialize the system. The configuration settings can be modified using the `vxitedit` program.

- `resman.o` is the National Instruments multimainframe Resource Manager. Run this program after running `vxiinit`.

- `victext.o` is an interactive control program that executes functions you enter from the keyboard. This text-based program helps you learn the functions, program your VXI devices, and develop and debug your application programs. This program is described in detail in the *NI-VXI Text Utilities Reference Manual*.

- `vxitedit.o` is the VXI resource editor program. You can use this text-based program to configure the system, edit the manufacturer name and ID numbers, and edit the model names of VXI and non-VXI devices in the system, as well as the system interrupt configuration information. This program also displays the system configuration information generated by the Resource Manager. This program is described in detail in the *NI-VXI Text Utilities Reference Manual*.

- `README` contains the latest updates and corrections to the manual when appropriate.

Additional Programs and Files

The `nivxi/tbl` directory contains the following files:

- `mfnameid.tbl` contains the database of manufacturer names and their ID numbers.
- `model.tbl` contains the database of model names, manufacturer names, and the model codes numbers.
- `device.tbl` contains the database of device names, manufacturer names, model names, and frame and slot associations for devices in the system.
- `nonvxi.tbl` contains the database for all non-VXI devices in the system.
- `intcfg.tbl` contains the system interrupt configuration information.
- `trigcfg.tbl` contains the system trigger configuration information.
- `utilbus.tbl` contains the utility bus configuration information.
- `creg.tbl` contains device-dependent information to be written to the control register by the Resource Manager.

The `nivxi/include` directory contains files for the C language interfaces.

- `nivxi.h` is the main header file containing the C prototypes for the NI-VXI functions.
- `datasize.h` contains data size specifications.
- `busacc.h` contains parameter and return values for the bus access functions.
- `devinfo.h` contains parameter and return values for the device information and system configuration functions.
- `vxiint.h` contains parameter and return values for the interrupt and signal functions.
- `sysint.h` contains parameter and return values for the system interrupt functions.
- `trig.h` contains parameter and return values for the trigger functions.
- `ws.h` contains parameter and return values for the Commander and Servant Word Serial functions.

The `nivxi/hlp` directory contains various help files used by the `victext` and `vxitedit` programs.

The `nivxi/example` directory contains various example programs that show how to use the NI-VXI software.

Appendix E
Software Driver Installation for the Optional SCSI Internal Hard Disk

This appendix describes the procedures for installing the software driver for the optional SCSI internal hard disk. If your VXIcpu-030 came equipped with an optional hard disk, or if you install your own hard disk, you will need to rebuild the VxWorks system image so that you can properly install it. Perform the following steps to install the software driver.

Note: ***This appendix is intended as an overview. Complete documentation on this topic is available in the*** *VxWorks Programmer's Guide****. Another source of assistance is the technical support staff of Wind River Systems.***

Step 1. Enable the SCSI Interface in VxWorks

To enable the SCSI interface in VxWorks, alter the `/usr/vw/config/niCpu030/config.h` file and change **`FALSE`** to **`TRUE`** in the first line of the following section:

```
#if      FALSE               /* change FALSE to TRUE for SCSI interface */
#define  INCLUDE_SCSI        /* include VXIcpu-030 SCSI interface */
#define  INCLUDE_SCSI_DMA    /* include VXIcpu-030 SCSI DMA interface */
#define  INCLUDE_SCSI_BOOT   /* include ability to boot from SCSI */
#define  INCLUDE_DOSFS       /* file system to be used */
#define  SCSI_AUTO_CONFIG    /* auto-configures SCSI */
#endif  /* FALSE/TRUE */
```

Step 2. Create a SCSI Physical Device Structure

The following code segment illustrates how to install a SCSI disk on the SCSI bus with ID 2, and logical unit number 0. This is the default VXIcpu-030 configuration. The disk is assumed to have a DOS file system present. To create a DOS file system, enter the following command at the prompt after rebuilding the operating system:

```
-> dosFsMkfs("/sd0/",pSbd0)
```

Edit the file `/usr/vw/src/config/usrScsi.c` and insert the following code in the `SCSI_AUTO_CONFIG` section:

```
   /* Configure physical devices on SCSI bus */
#ifdef SCSI_AUTO_CONFIG

   printf ("Auto-configuring SCSI bus...\n\n");

   /* Configure all SCSI bus devices */
   scsiAutoConfig (pSysScsiCtrl);
```

```
   /* Show parameters of connected SCSI bus devices */
   scsiShow (pSysScsiCtrl);
   printf ("\n");

   /* Get a pointer to the SCSI device on bus 0x2 with LUN 0x0 */
   pSpd20 = scsiPhysDevIdGet(pSysScsiCtrl, 0x2, 0x0);

   /* Prepare to use DOS library with max # of files set to 30 */
   dosFsInit(30);

   /* Create a block device structure for disk */
   pSbd0 = scsiBlkDevCreate(pSpd20, 0x0, 0x0);

   /* Associate block device with DOS file system */
   dosFsDevInit("/sd0/", pSbd0, 0x0);

   return (OK);
#endif
```

Step 3. Rebuild the Operating System Image

Rebuild the operating system image at this time. For instructions, refer to the *VxWorks Programmer's Guide*.

Step 4. Write the SCSI ID Value to Nonvolatile RAM

For the VXIcpu-030 SCSI controller to correctly recognize the internal SCSI disk, the ID of the SCSI disk must be written to nonvolatile RAM. This nonvolatile RAM value is used to drive the ID lines of the internal SCSI port.

Note: ***If you are using an external SCSI drive, this step is not required.***

To store this ID value, write the ID value of the drive to the memory location 0xfffe0280. Write the ID as a byte-sized value to avoid destroying information stored in the low-order byte of the word at 0xfffe0280.

To store the ID number of the drive in Step 3, perform the following at the VxWorks command prompt:

```
-> m 0xfffe0280
fffe0280:  0005-0205
fffe0282:  0000-.

value = 1 = 0x1
```

Step 5. Install the SCSI Device

Rebuild the operating system to install the SCSI device. After rebooting, the device should be installed. To verify the installation, perform the following command:

```
-> devs
drv name
 0  /null
 1  /tyCo/0
 1  /tyCo/1
 3  /sd0/   <— Note:  This is the newly installed SCSI device.
```

For additional information, consult the example code given in the `usrScsi.c` file or refer to the *VxWorks Programmer's Guide*.

Appendix F
Enabling Virtual Memory for the VXIcpu-030 and VxWorks

This appendix describes how to enable virtual memory for use with the VXIcpu-030 and the VxWorks operating system. With VxWorks version 5.1 and later you have the capability to use virtual memory to protect the operating system image and the vector table.

Note: ***This appendix is intended as an overview. Complete documentation on this topic is available in the*** *VxWorks Programmer's Guide****. Another source of assistance is the technical support staff of Wind River Systems.***

By default, the virtual memory capability of the VXIcpu-030 is disabled. Disabling virtual memory makes the entire VXI memory space (in particular the A32 space) available to you. Mapping the entire 3.75 GB of A32 space requires a substantial amount of RAM for the page table, which significantly reduces the amount available to user processes. Mapping the entire A32 space is not possible in the 4 MB memory configuration, but can be accomplished in the 8 MB configuration.

After you determine the required memory addresses used by your application, you may want to enable the virtual memory support to take advantage of its added protection. Follow these steps to enable the virtual memory support.

Step 1. Edit the Virtual Memory Page Description

Edit the virtual memory page description found in `/usr/vw/config/niCpu030/sysLib.c` to map the address ranges your application requires. Following is a typical page description.

```
PHYS_MEM_DESC sysPhysMemDesc [] =
    {
    /* adrs and length parameters must be page-aligned (multiples of
                                                            0x2000) */
    /* ram */
    {
    (void *) LOCAL_MEM_LOCAL_ADRS,      /* virtual address */
    (void *) LOCAL_MEM_LOCAL_ADRS,      /* physical address */
    0x1000000,                          /* 16 Mbytes (length) */
    /* state mask */
    VM_STATE_MASK_VALID | VM_STATE_MASK_WRITABLE | VM_STATE_MASK_CACHEABLE,
    VM_STATE_VALID      | VM_STATE_WRITABLE      | VM_STATE_CACHEABLE_NOT
    },
```

```
    /* some a32 vxi */
    {
    (void *) WIN3BASE,
    (void *) WIN3BASE,
    0x20000000,           /* 500 Mbytes (increase or decrease as needed) */
    VM_STATE_MASK_VALID | VM_STATE_MASK_WRITABLE | VM_STATE_MASK_CACHEABLE,
    VM_STATE_VALID      | VM_STATE_WRITABLE      | VM_STATE_CACHEABLE_NOT
    },

    ................
    };
```

Step 2. Include MMU Support

Edit the file `/usr/vw/config/all/configAll.h` and add the following line:

```
#define INCLUDE_MMU_BASIC      /* bundled mmu support */
```

Step 3. Rebuild the Operating System

Rebuild the operating system as described in the *VxWorks Programmer's Guide*.

Appendix G
Common Questions

This appendix addresses common questions you may have when configuring the VXIcpu-030 and the NI-VXI software for VxWorks. This material does not cover problems that you may have with the system. Please see Appendix H, *Troubleshooting*, if you have system-related problems.

How do I interface the LAN (Local Area Network) connector on the VXIcpu-030 to my network?

The VXIcpu-030 has a generic Access Unit Interface (AUI) connector that can connect to other Ethernet media (ThickNet, Fiberoptic, and so on) through third-party Media Access Unit (MAU) boxes. These can be purchased from almost any Ethernet board manufacturer. The LAN connector is the standard IEEE 802.3 DTE connector. The connector is a 15-pin D-Sub receptacle (HD-20). Refer to Appendix C, *Connectors*, for more information about the LAN connector.

How do I connect a terminal to the VXIcpu-030?

Connect the terminal to the CONSOLE serial port connector on the VXIcpu-030. The connector is a 9-pin D-Sub plug (HD-20). Refer to Appendix C, *Connectors*, for more information about the CONSOLE connector. The terminal settings are 9600 baud, 8 data, no parity, 1 stop bit.

How do I connect a SCSI device to the VXIcpu-030?

The SCSI connector of the VXIcpu-030 is a 50-pin High Density SCSI device connector. Remember that the SCSI bus is a daisy-chained bus. In other words, device A is cabled to device B, device B is cabled to device C, and so on. Only the end devices in your SCSI chain must have SCSI termination resistors installed. The middle devices must not have SCSI termination resistors installed. Each SCSI device must have a unique SCSI ID number. Refer to Appendix C, *Connectors*, for more information about the SCSI connector, and to Appendix E, *Software Driver Installation for the Optional SCSI Internal Hard Disk*, for information about installing SCSI devices under VxWorks.

How do I add more RAM to the VXIcpu-030? What is the maximum amount of RAM that I can have on the VXIcpu-030?

There VXIcpu-030 has two onboard SIMM sockets, labeled A1 and A2. To install more RAM on your VXIcpu-030, you must purchase a different set of SIMMs and install them in sockets A1 and A2, and change switches S3 and S4 to match the amount of RAM in your VXIcpu-030. The SIMMs should have access times of 70 ns or faster and should support fast-page mode accesses.

Use Toshiba SIMMs, part number THM36xxxxAS(G)-70, or use an equivalent type of SIMM. The VXIcpu-030 can have a maximum of 32 MB of RAM. For more information about installing more RAM in your VXIcpu-030, refer to the *Installed System RAM Configuration* section of Chapter 2, *VXIcpu-030 Configuration and Installation*.

How do I install the VXIcpu-030 in a slot other than Slot 0 and prevent the VXIcpu-030 from being the Resource Manager?

You must make changes in both the hardware and software configuration to set the VXIcpu-030 up in this manner.

Follow these steps to reconfigure the VXIcpu-030 hardware as a Non-Slot 0 device:

1. Move switch S10 to the leftmost position for the Non-Slot 0 setting (illustrated in Figure 2-4b in Chapter 2, *VXIcpu-030 Configuration and Installation*). This switch controls the MODID signal termination.
2. Move switch S8 to the leftmost position (illustrated in Figure 2-5b in Chapter 2). This switch enables or disables the System Controller functions, which you need to disable for Non-Slot 0 operation.
3. Move the jumper at W1, located on the back side of the VXIcpu-030, to the leftmost column of pins (*away* from the `SLOT 0` enscription, as illustrated in Figure 2-6b in Chapter 2). This jumper setting configures the backplane CLK10 interface.
4. Move switch S83 to the rightmost position (illustrated in Figure 2-9b in Chapter 2). This switch controls the CLK10 source selection setting.
5. Install the board in a slot other than Slot 0.

Follow these steps to reconfigure the VXIcpu-030 in software:

1. Type `vxitedit` to run the VXI resource editor program. Select the Configuration Editor.
2. In the Logical Address Configuration Editor, change the **Logical Address** parameter from 0 to a non-zero value.
3. In the Bus Configuration Editor, change both the **Local Bus Timeout** parameter and the **VXI Bus Timeout** parameter to 0 (disabled).
4. Save your changes in `vxitedit` and rerun `vxiinit` and `resman`.

Notes:
If your board is set up as a message-based device, it must wait for the actual Resource Manager device (at Logical Address 0) to send the Word Serial command *Begin Normal Operation*. This can occur only after you run `resman`. If your board is set up as a register-based device, you do not have to run `resman`. But running `resman` will not cause any problems.

To set whether your board is message-based or register-based, use the Logical Address Configuration Editor in `vxitedit` to edit the **Device Type** field: 2 = Message-Based; 3 = Register-Based.

What software is provided with the NI-VXI software for VXIcpu-030 for VxWorks?

The software contains the NI-VXI, ESP-488 GPIB, Serial Port, and Parallel Port software components. These software packages reside in subdirectories under the `/niCpu030` directory, and are named `nivxi`, `gpib`, `serial`, and `parallel`, respectively. The VxWorks Development System, which includes the VxWorks operating system, is not included in this kit. You must order VxWorks separately from Wind River Systems, Inc. The VxWorks Board Support Package for the VXIcpu-030 must also be ordered separately from Wind River Systems, Inc.

If I choose the default installation, what directory structure will be created?

The `nivxi`, `gpib`, `serial`, and `parallel` directories will be created in your working directory. The `nivxi` directory will contain `tbl`, `hlp`, `include`, and `example` directories.

How do I load the NI-VXI software driver and utilities?

There are two options for loading and linking the NI-VXI software. One option is to load the NI-VXI software into the VxWorks operating system before your application requires it. You can include the following lines in your startup script to load the NI-VXI modules at boot time.

```
ld < {path}/nivxi/nivxi.o
ld < {path}/nivxi/resman.o
ld < {path}/nivxi/vxitedit.o
ld < {path}/nivxi/victext.o
vxiinit()
```

where `{path}` should be set to the location where you have installed the NI-VXI utilities.

The second option is to actually link the NI-VXI software into the VxWorks system image. This action ensures that the NI-VXI software is available as soon as the operating system finishes booting.

For more information about loading the NI-VXI software, refer to Chapter 3, *NI-VXI Software Installation and Configuration*.

How can I use the 32 MB option for the VXIcpu-030? How do I ensure that all my device drivers use the lower 16 MB of RAM?

You need to configure the VxWorks to have 16 MB of RAM or less when it boots and then add the remaining RAM after startup. Because the device drivers allocate their memory requirements at startup, they will not be able to use the upper 16 MB of RAM. For more details refer to *Step 1. Configure Your Memory*, at the beginning of Chapter 3, *NI-VXI Software Installation and Configuration*.

Which NI-VXI utility program must I use to configure the VXIcpu-030?

You must use the `vxitedit` program to configure the VXIcpu-030. Use the Logical Address Configuration Editor, Bus Configuration Editor, and Device Configuration Editor to change aspects of the hardware and software operation of the VXIcpu-030. This information is used by the VXI hardware initialization program, `vxiinit`, and by the VXI Resource Manager program, `resman`. For more information about the `vxitedit` program and its editors, refer to Chapter 3, *NI-VXI Software Installation and Configuration*.

How do I restore the Ethernet address for the VXIcpu-030 to the factory configuration?

Refer to the *Restoring the Ethernet Address* section in Chapter 2, *VXIcpu-030 Configuration and Installation*.

Appendix H
Troubleshooting

This appendix addresses certain problems that can occur after you have configured your VXIcpu-030 computer. If Appendix G, *Common Questions* did not contain the information you need, these problem solutions may provide the answer.

When I boot the VXIcpu-030, the system hangs.

When booting across a network, VxWorks will try to boot in either of two ways. If you supply a password in the VxWorks boot parameter, the VXIcpu-030 will try to access the VxWorks image via the file transfer protocol (ftp) to the host. If no password is supplied, the VXIcpu-030 will use a remote shell (rsh) session to load the image.

If you are using ftp to access the VxWorks image:
Verify that the **ftp password** parameter is correct. If the password is correct, it is possible that the VXIcpu-030 is unable to find the host machine. If the host and the VXIcpu-030 are on different subnets on your system—if A.B.C.D is the format of the IP address, the C number will be different if the host and embedded computers are on different subnets—you must supply the gateway machine IP address in the **gateway inet** boot parameter. If the gateway is correct, check your host IP address in the **host inet** boot parameter to ensure that you are contacting the correct machine. See the *Getting Started* and *Network* sections in the *VxWorks Programmer's Guide* from Wind River Systems for more information on boot parameters.

If you are using rsh to access the VxWorks image:
The first step is to attempt to use the ftp technique to load the image. If the ftp technique does not work, see the section above on getting ftp to load the VxWorks image. If the ftp technique does work, then the most likely cause of the problem is that the VXIcpu-030 does not have authorization to access the host machine. When using rsh, the VXIcpu-030 must have an entry in the `.rhosts` file on the remote machine to gain permission to access the files.

Whenever a machine attempts to perform an rsh to a remote host, the host will check if that machine has an entry in the `.rhosts` file in the home directory of the user attempting to connect. The `.rhosts` file contains entries of the following form:

```
machine-name username
```

where *machine-name* is the Internet address of the machine attempting to connect to the host.

As a specific example, if the **target name** boot parameter is **homer.natinst.com** and the VXIcpu-030 **user** boot parameter is **cpu-030**, the `.rhosts` file in the user account (in this case, **cpu-030**) on the host would contain the following line:

```
homer.natinst.com  cpu-030
```

For more information on remote booting refer to the *Getting Started* and *Network* sections in the *VxWorks Programmer's Guide*.

At boot-up, the VXIcpu-030 gives a warning about duplicate IP addresses.

If you get a **`Duplicate IP address`** warning while booting the VXIcpu-030, check the **inet on ethernet** boot parameter (the VXIcpu-030 IP address) to make sure it is the unique address of the VXIcpu-030.

The VXIcpu-030 prompts that it is unable to load the boot file.

If the **file name** boot parameter does not specify the proper filename or path, the VXIcpu-030 will not be able to find the boot file. Verify that this parameter is correct. If the parameter is correct, the VXIcpu-030 may be having problems accessing the host machine. Review the ***When I boot the VXIcpu-030, the system hangs*** problem above for more information.

When I boot off the SCSI or backplane, I can't access Ethernet.

The **boot device** boot parameter directs where the VXIcpu-030 should search for the boot image. If Ethernet is not chosen, the Ethernet option should be listed in the *other* boot parameter in order to enable the Ethernet.

When I run resman, it reports errors about .tbl files.

`resman` uses the **NI-VXI Path** setting in the `vxitedit` program to look for `.tbl` files. If this path is incorrect, `resman` will be unable to store its system information. Verify this path variable in the Device Configuration Editor of `vxitedit`. For more information, refer to Chapter 3, *NI-VXI Software Installation and Configuration.*

My internal hard disk used to work fine, but after I lost the contents of my NVRAM, the disk does not work anymore.

Follow the instructions in Appendix E, *Software Driver Installation for the Optional SCSI Internal Hard Disk*. Pay particular attention to Step 4 in this appendix.

I built new EPROMS for my VXIcpu-030 and now it takes over 10 seconds to boot. (Note: *This section is for experienced VxWorks users only*.)

If you need to build new EPROMS for your VXIcpu-030, you can either build compressed or uncompressed bootroms. Compressed bootroms require less space than uncompressed, but require an uncompress utility to be run when the VXIcpu-030 is booting. This uncompress utility requires several seconds to uncompress the bootroms before the VXIcpu-030 can begin booting. This delay can be as long as 15 seconds for extremely large boot code. Notice that the VXI specification requires devices to enter the PASSed state within five seconds or the device can be considered non-functioning by the Resource Manager. Therefore, this long delay can create problems in your system. The VXIcpu-030 ships with uncompressed bootroms for this reason. If you need to rebuild the VXIcpu-030 bootroms you should build uncompressed bootroms. For additional information on rebuilding the VXIcpu-030 bootroms see the *Configuration* chapter of the *VxWorks Programmer's Guide*.

Appendix I
Customer Communication

For your convenience, this appendix contains forms to help you gather the information necessary to help us solve technical problems you might have as well as a form you can use to comment on the product documentation. Filling out a copy of the *Technical Support Form* before contacting National Instruments helps us help you better and faster.

National Instruments provides comprehensive technical assistance around the world. In the U.S. and Canada, applications engineers are available Monday through Friday from 8:00 a.m. to 6:00 p.m. (central time). In other countries, contact the nearest branch office. You may fax questions to us at any time.

Electronic Services

Bulletin Board Support

National Instruments has BBS and FTP sites dedicated for 24-hour support with a collection of files and documents to answer most common customer questions. From these sites, you can also download the latest instrument drivers, updates, and example programs. For recorded instructions on how to use the bulletin board and FTP services and for BBS automated information, call
(512) 795-6990. You can access these services at:

United States: (512) 794-5422 or (800) 327-3077
Up to 14,400 baud, 8 data bits, 1 stop bit, no parity

United Kingdom: 01635 551422
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

France: 1 48 65 15 59
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

FTP Support

To access our FTP site, log on to our Internet host, `ftp.natinst.com`, as anonymous and use your Internet address, such as `joesmith@anywhere.com`, as your password. The support files and documents are located in the `/support` directories.

FaxBack Support

FaxBack is a 24-hour information retrieval system containing a library of documents on a wide range of technical information. You can access FaxBack from a touch-tone telephone at the following number:

(512) 418-1111

E-Mail Support (currently U.S. only)

You can submit technical support questions to the appropriate applications engineering team through e-mail at the Internet addresses listed below. Remember to include your name, address, and phone number so we can contact you with solutions and suggestions.

GPIB:	gpib.support@natinst.com
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National Instruments has branch offices all over the world. Use the list below to find the technical support number for your country. If there is no National Instruments office in your country, contact the source from which you purchased your software to obtain support.

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Belgium	02 757 00 20	02 757 03 11
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Denmark	45 76 26 00	45 76 26 02
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Germany	089 741 31 30	089 714 60 35
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Korea	02 596 7456	02 596 7455
Mexico	95 800 010 0793	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
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Sweden	08 730 49 70	08 730 43 70
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Technical Support Form

Photocopy this form and update it each time you make changes to your software or hardware, and use the completed copy of this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

If you are using any National Instruments hardware or software products related to this problem, include the configuration forms from their user manuals. Include additional pages if necessary.

Name _____

Company _____

Address _____

_____

Fax (___)_____ Phone (___)_____

Computer brand _____ Model _____ Processor _____

Operating system (include version number) _____

Clock Speed _____MHz RAM _____MB Display adapter _____

Mouse _____yes _____no Other adapters installed _____

Hard disk capacity _____MB Brand _____

Instruments used _____

National Instruments hardware product model _____ Revision _____

Configuration _____

National Instruments software product _____ Version _____

Configuration _____

The problem is _____

_____

_____

_____

_____

List any error messages _____

_____

_____

_____

_____

The following steps will reproduce the problem _____

_____

_____

VXIcpu-030 Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Complete a new copy of this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

National Instruments Products

- VXIcpu-030 ID Label Information:
  - Part Number _____
  - Serial Number _____
  - Revision _____
- Amount of Installed RAM: _____
- Coprocessor: _____
- Hard Disk Size: _____
- VXIcpu-030 Configuration Information (see Chapter 2):
  - Factory Configuration _____ yes _____ no

    If no, give the following information:

    VXIbus Slot, CLK10, and External CLK I/O Configuration (Table 2-2):

    _____ A* _____ B _____ C _____ D _____ E _____ F
  - MODID Signal Termination Configuration (Figure 2-4):

    _____ for Slot 0* _____ for Non-Slot 0
  - System Controller Configuration (Figure 2-5):

    _____ Enabled (Slot 0)* _____ Disabled (Non-Slot 0)
  - Backplane CLK10 Configuration (Figure 2-6):

    _____ Slot 0, Onboard* _____ Non-Slot 0
  - Front Panel CLK I/O Configuration (Figure 2-7):

    _____ As Input* _____ As Output

    * Factory Configuration

– Front Panel CLK I/O Termination Configuration (Figure 2-8):

_____ Unterminated* _____ Terminated

– CLK10 Source Selection Configuration (Figure 2-9):

_____ Onboard 10 MHz* _____ Front Panel

– External Trigger Input Configuration (Figure 2-11):

_____ Unterminated* _____ Terminated

* Factory Configuration

- Software Information
  - VxWorks Version _____
  - Serial Port Software Version _____
  - ESP-488 GPIB Software Version _____
  - NI-VXI Software Version _____
- NI-VXI Software Configuration Information (see Chapter 3)
  - Logical Address Configuration Editor

    Logical Address _____

    Device Type _____

    Address Space _____

    VXI Shared RAM _____

    Slave Block Transfer Mode _____

    Slave Supervisory Access Only? _____

    Resource Manager Delay (seconds) _____

    Servant Area Size _____

    Protocol Register _____

    Response for *Read Protocol* Command _____

    Number of Handlers _____

    Number of Interrupters _____

    WS Poll Value _____

– Bus Configuration Editor

Bus Request Level _____

Fair Requester Timeout (µs) _____

Bus Release Mechanism _____

Bus Arbitration _____

Local Bus Timeout (µs) _____

VXIbus Timeout (µs) _____

VIC Port _____

– Device Configuration Editor

NI-VXI Path _____

Pushbutton Reset to SYSRESET Action _____

SYSRESET Action _____

Pushbutton Reset to Local Reset Action _____

Other Products

• Other VXIbus Devices:

Manufacturer	Model	Function	Slot	Logical Address

- Other Equipment Used:

Manufacturer	Model	Function

Continue on a separate sheet, if necessary.

- VXI or VME Interrupt Level(s) of Other Products (Handler/Interrupter; indicate if VME) _____
- VXIbus Mainframe Manufacturer and Model _____
- IEEE 488 Bus Devices (Manufacturer, Model, GPIB Address) _____
- RS232/422 Devices (Manufacturer, Model) _____
- SCSI Devices (Manufacturer, Model) _____

Documentation Comment Form

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Title: **Getting Started with Your VXIcpu-030® and the NI-VXI™ Software for the VxWorks Operating System**

Edition Date: **May 1996**

Part Number: **320511D-01**

Please comment on the completeness, clarity, and organization of the manual.

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Glossary

Prefix	Meaning	Value
µ-	micro-	10^{-6}
m-	milli-	10^{-3}
K-	kilo-	10^{3}
M-	mega-	10^{6}
G-	giga-	10^{9}

Symbols

°	degrees
Ω	ohms
%	percent

A

A	amperes
A16 space	VXIbus address space equivalent to the VME 64 KB *short* address space. In VXI, the upper 16 KB of A16 space is allocated for use by VXI devices configuration registers. This 16 KB region is referred to as VXI configuration space.
A24 space	VXIbus address space equivalent to the VME 16 MB *standard* address space.
A32 space	VXIbus address space equivalent to the VME 4 GB *extended* address space.
address modifier	One of six signals in the VMEbus specification used by VMEbus masters to indicate the address space and mode (supervisory/nonprivileged, data/ program/block) in which a data transfer is to take place.
address space	A set of 2^n memory locations differentiated from other such sets in VXI/VMEbus systems by six signal lines known as address modifiers. *n* is the number of address lines required to uniquely specify a byte location in a given space. Valid numbers for *n* are 16, 24, and 32.

ASIC	Application Specific Integrated Circuit (a semi-custom chip)

B

backplane	The printed circuit board that is mounted in a mainframe to serve as the interface between modules.
BTO unit	Bus Timeout Unit; a functional module that times the duration of each data transfer and terminates the cycle if the duration is excessive. Without the termination capability of this module, an access to a nonexistent slave could result in an indefinitely long wait for a slave response. The VXIbus BTO should be at least 100 µs.

C

C	Celsius
CLK10	A 10 MHz, ± 100 ppm, individually buffered (to each module slot), differential ECL system clock that is sourced from Slot 0 and distributed to the other slots on P2.
Commander	A message-based device which is also a bus master and can control one or more Servants.

D

daisy-chain	A signal line used to propagate a signal level from board to board on a priority basis, starting with the first slot and ending with the last slot.
dynamically configured device	A device that has its logical address assigned by the Resource Manager. A VXI device initially responds at Logical Address 255 when its MODID line is asserted. A MXIbus device responds at Logical Address 255 during a priority select cycle. The Resource Manager subsequently assigns it a new logical address, which the device responds to until powered down.

E

ECL	Emitter-Coupled Logic
embedded controller	An intelligent CPU (controller) interface plugged directly into the VXI backplane, giving it direct access to the VXIbus.
EPROM	Erasable Programmable Read Only Memory

Extended Class device	A class of VXIbus device defined for future expansion of the VXIbus specification. These devices have a subclass register within their configuration space that defines the type of extended device.

G

GB	4,294,967,296; Gigabytes of memory
GPIB	General Purpose Interface Bus; the industry standard IEEE 488 bus.

H

Hz	Hertz (cycles per second)

I

IACK*	Interrupt Acknowledge; a signal on the backplane used by an interrupt handler to acknowledge an interrupt request.
IEEE	Institute of Electrical and Electronics Engineers
in.	inches
interrupt	A means for a device to request service from another device.

K

KB	1,024; kilobytes of memory

L

LAN	local area network
LED	light emitting diode
logical address	An 8-bit number that uniquely identifies the location of a VXIbus device's configuration registers in a system. The A16 base address of a device is C000h + Logical Address * 40h.

M

MB	1,048,576; Megabytes of memory
m	meters
message-based device	An intelligent device that implements the defined VXIbus registers and communication protocols. These devices are able to use Word Serial Protocol to communicate with one another through communication registers.
MODID	A set of signal lines on the VXI backplane that VXI systems use to identify which modules are located in which slots in the mainframe.

N

NI-VXI	The National Instruments bus interface software for VME/VXIbus/ MXIbus systems.

R

register-based device	A Servant-only device that supports VXIbus configuration registers. register-based devices are typically controlled via device-dependent register reads and writes.
resman	The name of the National Instruments Resource Manager application in the NI-VXI bus interface software. See *Resource Manager*.
Resource Manager	A message-based Commander located at Logical Address 0, which provides configuration management services such as address map configuration, Commander and Servant mappings, and self-test and diagnostic management.

S

s	seconds
SCSI	Small Computer System Interface (bus)
Servant	A device controlled by a Commander.
Slot 0 Module	A VXIbus device that provides the VMEbus System Controller services and the VXIbus CLK10 and MODID functions. Additional Slot 0 services include trigger control.

statically configured device	A device whose logical address cannot be set through software; that is, it is not dynamically configurable.
SYSCLK	System Clock; a 16 MHz clock on the backplane that is independent of any other bus timing.
SYSFAIL*	System Fail; a signal that indicates when a failure has occurred in the system; can be generated by any board in the system.
SYSRESET*	System Reset; a signal that indicates a system reset or power-up condition.
System Controller	A functional module that has arbiter, daisy-chain driver, and MXIbus cycle timeout responsibility. Always the first device in the MXIbus daisy-chain. Sometimes a VXI Slot 0 module is referred to as the System Controller.

T

trigger	Either TTL or ECL lines used for intermodule communication.
TTL	Transistor-Transistor Logic

V

V	Volts
VDC	Volts Direct Current
victext	VXI Interactive Control program, a part of the NI-VXI bus interface software package. Used to program VXI devices and develop and debug VXI application programs.
VME	IEEE 1014, the IEEE Standard for a Versatile Backplane Bus.
VXIbus	VMEbus Extensions for Instrumentation
vxitedit	VXI Resource Editor program, a part of the NI-VXI bus interface software package. Used to configure the system, edit the manufacturer name and ID numbers, edit the model names of VXI and non-VXI devices in the system, as well as the system interrupt configuration information, and display the system configuration information generated by the Resource Manager.

W

W	watts
Word Serial Protocol	The simplest required communication protocol supported by message-based devices in the VXIbus system. It utilizes the A16 communication registers to transfer data using a simple polling handshake method.
WS Poll Value	The number of iterations before the processor is given up to try another device.

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